



## ROADMAP 2050 DOCUMENT LEGEND

**MAIN NARRATIVE**

PAGES ON THE MAIN NARRATIVE LINE EXPLAIN THE ESSENTIALS OF ROADMAP 2050; INCLUDES TECHNICAL GRAPHICS, SPATIAL PLANNING AND VISUALIZATION OF THE GRID.

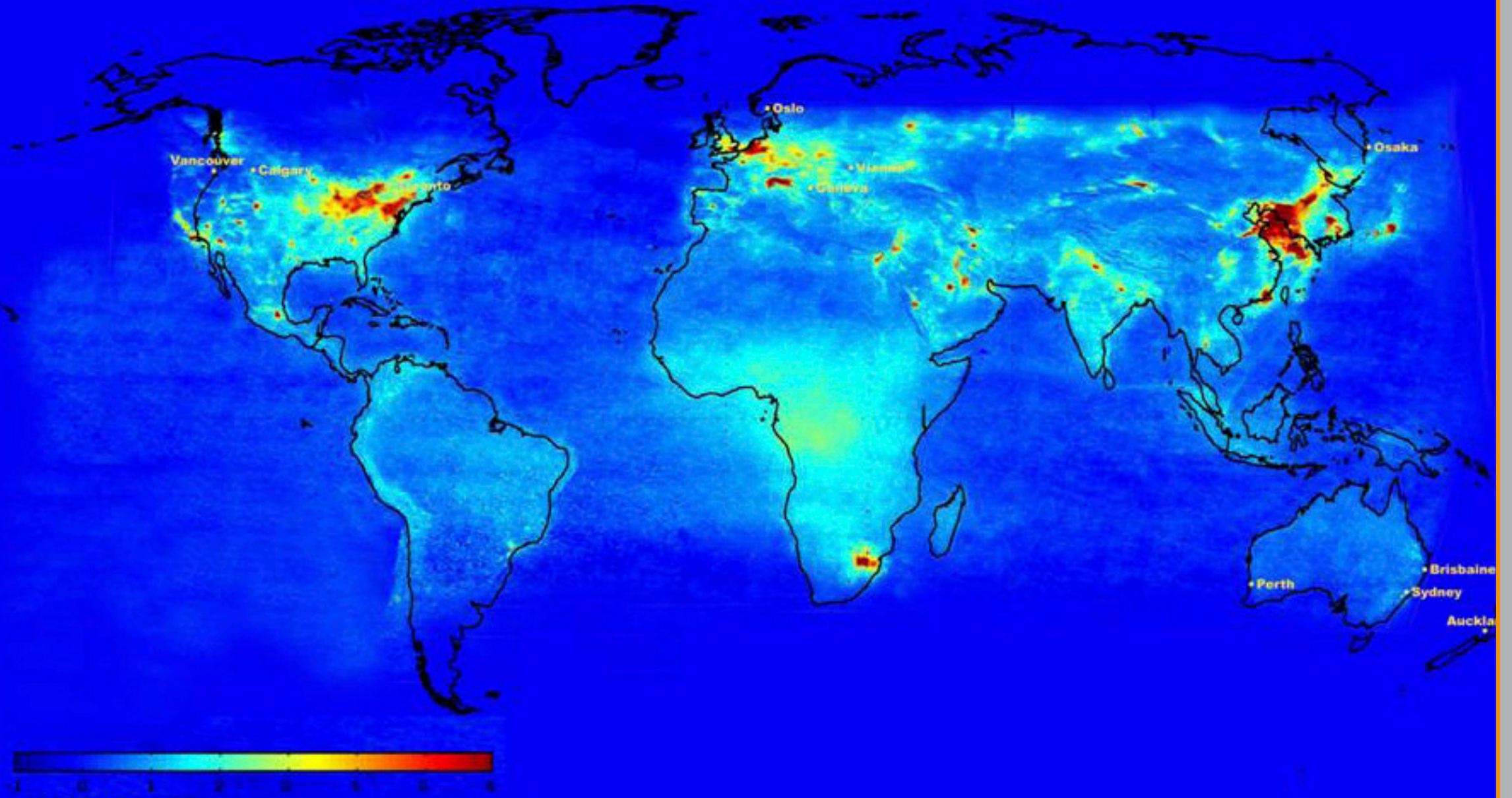
**DETOUR**

A DETOUR STOP EXPLAINS COMPONENTS OF THE PROPOSAL OUTSIDE THE MAIN NARRATIVE; INCLUDES ADDITIONAL INCENTIVES, ELABORATION OF PROJECT GRAPHICS, AND VISUALIZATIONS.

**TRANSCRIPTS**

INTERVIEWS, WORKSHOPS, AND DISCUSSIONS SCHEDULED TO PROVIDE FURTHER INSIGHT INTO THE ROADMAP

SINCE THE INDUSTRIAL REVOLUTION, TECHNOLOGICAL BREAKTHROUGHS HAVE CHANGED THE WAY WE LIVE. AT THE SAME TIME, WE HAVE BECOME DEPENDENT ON FOSSIL FUELS FOR ENERGY. HOW CAN WE SUSTAIN OUR WAY OF LIFE AND STOP THE FURTHER POLLUTION OF THE ATMOSPHERE?



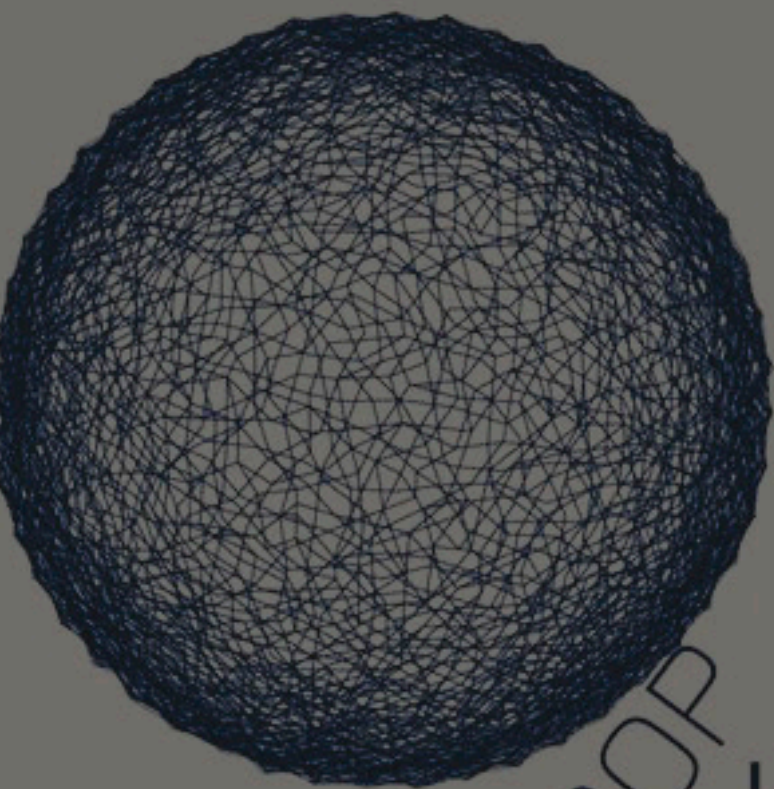
WITHOUT DRASTIC REDUCTIONS IN GLOBAL CO2 EMISSIONS, THE EARTH'S TEMPERATURE COULD RISE AS MUCH AS SIX DEGREES CELSIUS BY THE END OF THE CENTURY...



Do Nothing Scenario

SOURCES:  
[www.grida.no/go](http://www.grida.no/go)  
[www.ipcc.ch](http://www.ipcc.ch)  
[www.epa.gov/climatechange](http://www.epa.gov/climatechange)  
There is a general scientific consensus that the Earth's most extreme temperature has fluctuated between about 1 degree Celsius for the last 2000yrs. So 2 degrees or even 6 degrees would be a comparatively enormous change!

COPENHAGEN RECOGNIZED THE CASE FOR KEEPING THE RISE IN TEMPERATURE BELOW 2 DEGREES, BUT FAILED TO PRODUCE A BINDING AGREEMENT ...

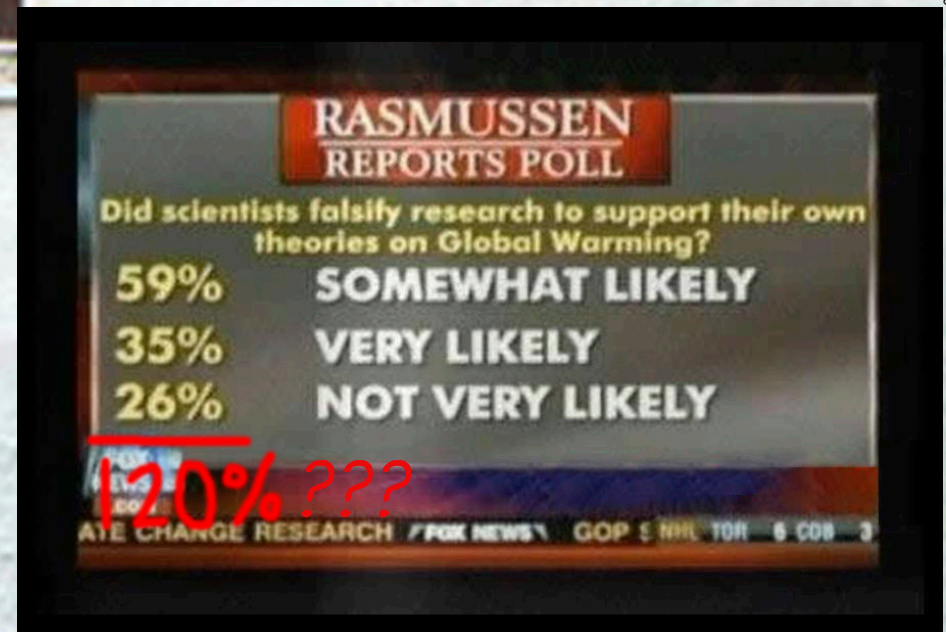


COP15  
COPENHAGEN  
CLIMATE CHANGE CONFERENCE 2009

...LEAVING LEADERS WITH TARNISHED REPUTATIONS...



... AND ALLOWING DOUBT TO PREVAIL IN THE DEBATE ABOUT GLOBAL WARMING.



I DON'T BELIEVE IN GLOBAL WARMING

SOURCES:  
[www.economist.com](http://www.economist.com), [www.rasmussenreports.com](http://www.rasmussenreports.com), [www.foxnews.com](http://www.foxnews.com)

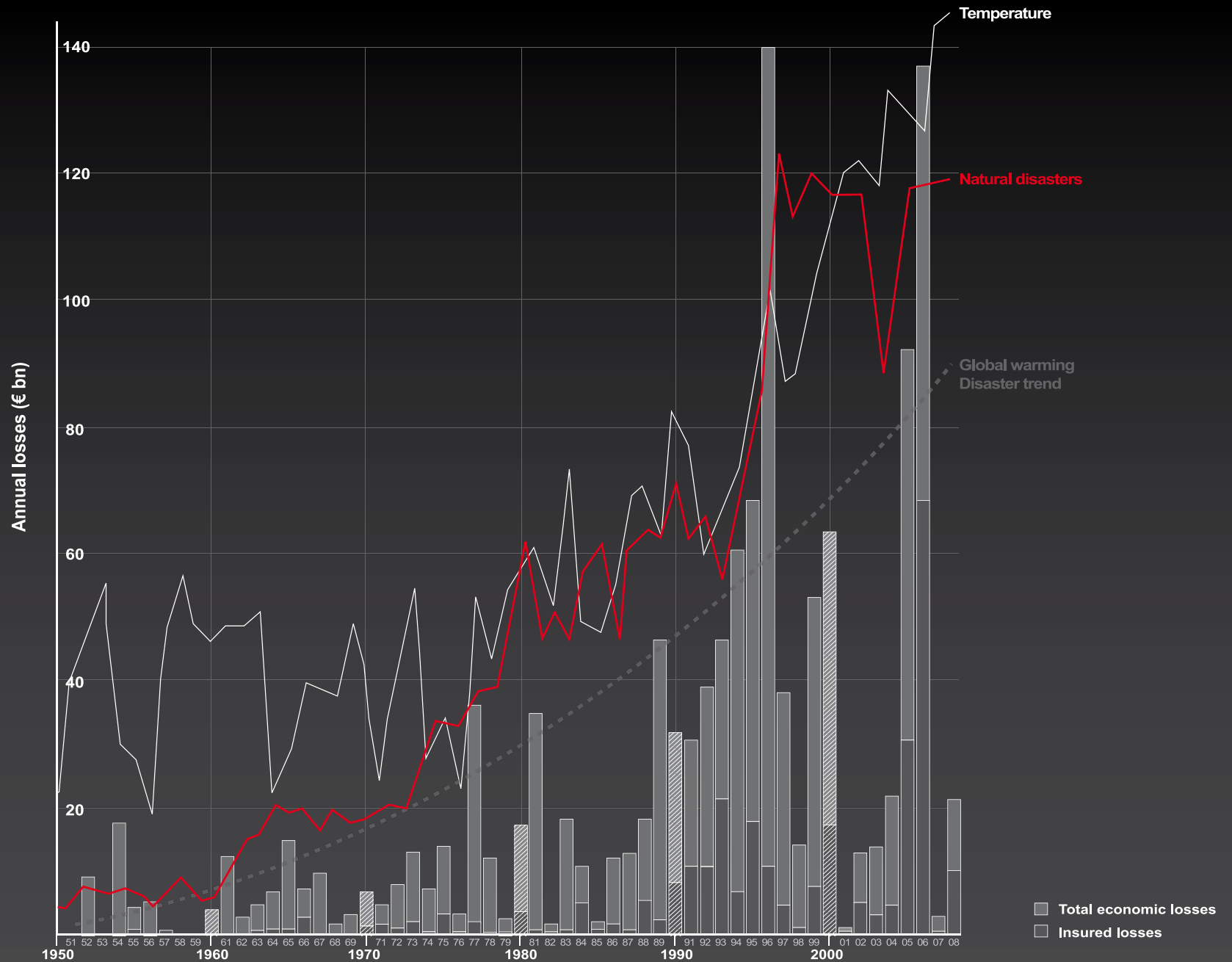
*Climate Science: Spin, Science and Climate Change*  
 'Action on climate is justified: not because the science is certain, but precisely because it is not.'  
 Leaders Article in The Economist, March 18th 2010

# 'CLIMATE INCIDENTS'





WITH THE COST ESTIMATIONS OF NATURAL DISASTERS EVER INCREASING, FAILURE TO ACKNOWLEDGE THE UNDERLYING CAUSE COULD COME AT A VERY HIGH PRICE.



SOURCE: Munich-Re (2009)

OCTOBER 30, 2009: EUROPEAN LEADERS ENDORSE THE OBJECTIVE OF AN 80% - 95% REDUCTIONS IN CO<sub>2</sub> EMISSION BY 2050.

80%-95% Less CO<sub>2</sub>



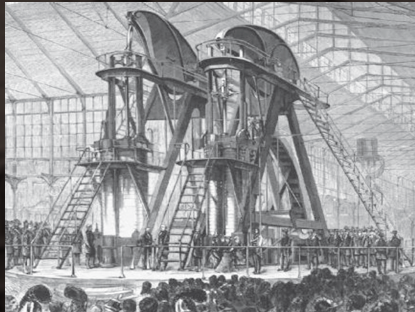
COOPERATION AND PLANNING WILL BE CRUCIAL.  
MEETING THE EMISSIONS REDUCTION TARGET  
REQUIRES THE MOBILIZATION AND AGREEMENT OF ALL  
INVOLVED...



**“History we know, is apt to repeat itself.”**

1858 G. Eliot Janet's Repentance in Scenes of Clerical Life II.

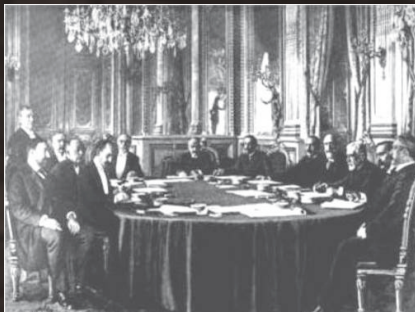
# 1780 - 1880



The steam revolution began.



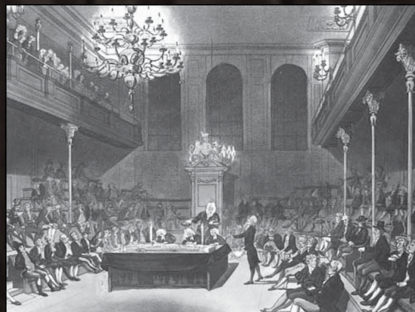
Lobbyist tried to scare the public...



But, governments brought stability...



Aristocrats lobbied against the change...



But, planning & investment triumphed...



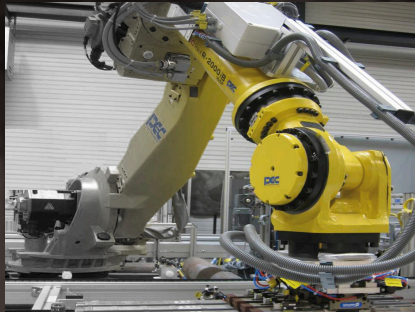
The industry grew beyond expectation...



In less than 50 years, the railroad revolutionized transport.

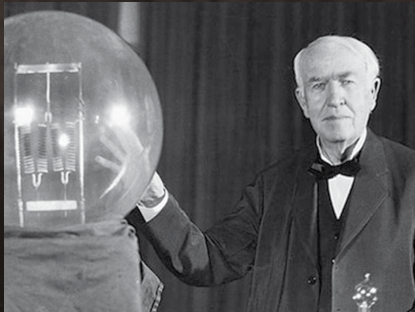


The revolution thrived...



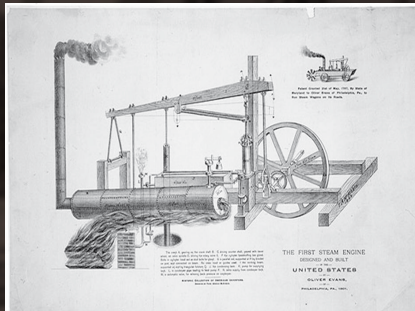
In less than 40 years, the industrial revolution changed the world forever...

# 1899 - 1929



The electric revolution began.

# 1839 - 1890



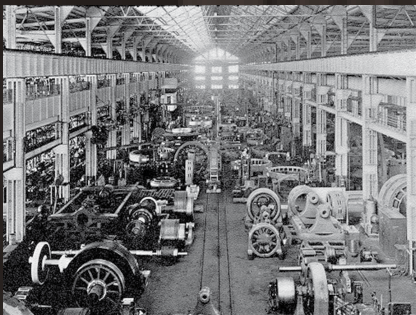
The railroad revolution began.



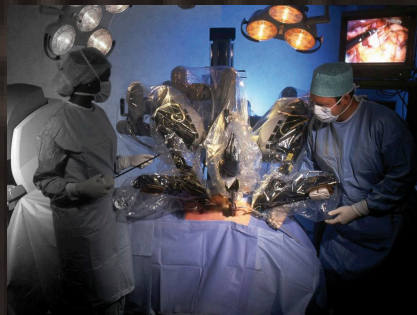
Fear and ignorance confused the public...



But, government vision brought order...



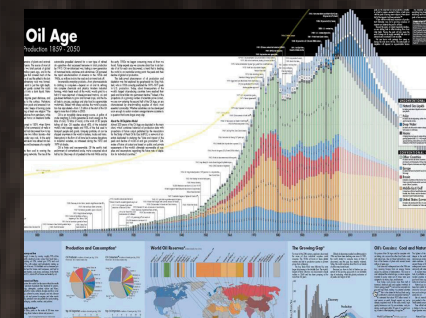
The revolution exploded with innovation...



In less than 30 years, the impossible became possible.



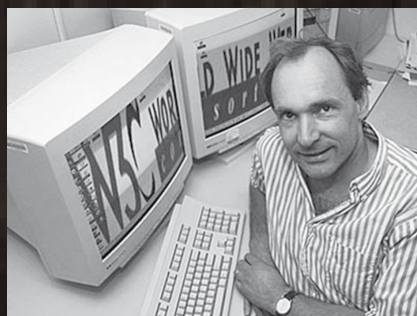
2010 - 2050



The renewable energy revolution began.



1974 - 2000



The technological revolution began.



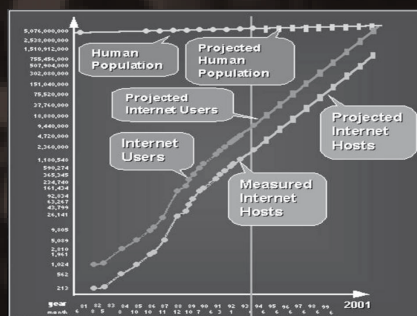
But, ignorance continues to mislead...



Cooperation & planning will be crucial...



Fear and distrust soared.



But, users overcame the skeptics...



The revolutionary potential is endless...



And we have only scratched the surface...



The revolution created new opportunities...



In less than 25 years, technology changed the way we live.



History is about to repeat...



Is the EU ready?

# ROADMAP 2050

## A PRACTICAL GUIDE TO A PROSPEROUS, LOW-CARBON EUROPE

THE MISSION OF ROADMAP 2050 IS TO PROVIDE A PRACTICAL, INDEPENDENT AND OBJECTIVE ANALYSIS OF PATHWAYS TO ACHIEVE A LOW-CARBON ECONOMY IN EUROPE, IN LINE WITH THE ENERGY SECURITY, ENVIRONMENTAL AND ECONOMIC GOALS OF THE EUROPEAN UNION.



VOLUME 1	ECF (PHILANTHROPIC EUROPEAN CLIMATE FOUNDATION)	<ul style="list-style-type: none"> <li>OVERALL SPONSOR AND FUNDER</li> </ul>
	McKINSEY & COMPANY (STRATEGIC CONSULTANCY)	<ul style="list-style-type: none"> <li>OVERALL CONTENT ANALYSIS, PROJECT MANAGEMENT, DATA COLLECTION</li> <li>REACH OUT TO INDUSTRIES, WORKSHOP FACILITATION</li> </ul>
	KEMA (TECHNICAL GRID CONSULTANCY)	<ul style="list-style-type: none"> <li>GRID DESIGN AND INVESTMENTS, PRODUCTION CAPACITY AND COSTS ASSOCIATED WITH PROVIDING A PLAUSIBLE, SECURE ELECTRICITY SYSTEM FOR EACH OF THE PATHWAYS</li> </ul>
	IMPERIAL COLLEGE LONDON	<ul style="list-style-type: none"> <li>IN-DEPTH MODELING OF SYSTEM BALANCING REQUIREMENTS, RELIABILITY, OPTIMIZATION OF TRANSMISSION AND BACK-UP INVESTMENT</li> </ul>
VOLUME 2	OXFORD ECONOMICS (MACRO-ECONOMIC CONSULTANCY)	<ul style="list-style-type: none"> <li>PROVIDE ANALYSIS OF MACRO-ECONOMIC IMPACTS OF DECARBONIZATION SCENARIOS</li> </ul>
	E3G	<ul style="list-style-type: none"> <li>COAUTHOR OF POLICY VOLUME 2</li> <li>POLICY INSIGHTS BASED ON THE ANALYTICS</li> </ul>
VOLUME 3	ECN (ENERGY RESEARCH CENTER OF THE NETHERLANDS)	<ul style="list-style-type: none"> <li>SUPPORT ON ASSUMPTIONS FOR TECHNOLOGIES</li> <li>POLICY DEVELOPMENT AND RECOMMENDATIONS BASED ON ANALYTICS</li> </ul>
	OFFICE FOR METROPOLITAN ARCHITECTURE	<ul style="list-style-type: none"> <li>PROVIDE CREATIVE PARTICIPATION IN THE DEVELOPMENT OF NARRATIVE. PROVIDE CONCEPTUAL FRAMING AND VISUAL COMMUNICATION</li> <li>SPATIAL PLANNING AND VISUALIZATION OF THE GRID</li> </ul>



# CO<sub>2</sub> PARADOX

FOR EVERY BARREL OF OIL WE BURN THREE TIMES THE QUANTITY OF CO<sub>2</sub> IS BEING PRODUCED. THIS MEANS OUR ACTUAL CARBON FOOTPRINT IS ALMOST THREE TIMES THE SIZE OF OUR OIL CONSUMPTION FOOTPRINT!

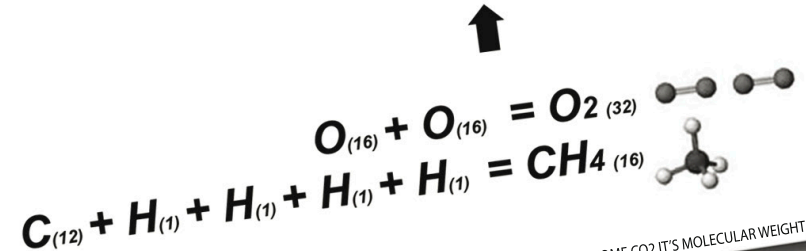
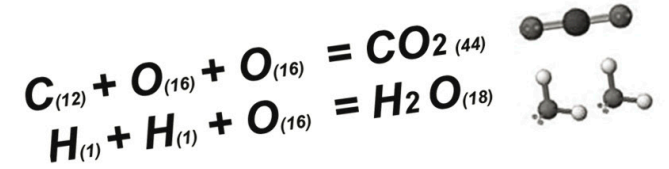
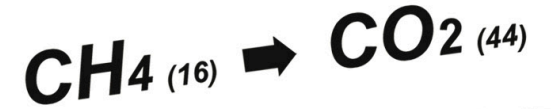
**502kg**  
(CARBON DIOXIDE EQUIVALENT)  
**CO<sub>2</sub> (44)**



**160kg**  
(BARRELS OF OIL EQUIVALENT)  
**C<sub>(n)</sub>H<sub>2(n)</sub> (14)**

Note: Hydrocarbons exist in many forms but the principle remains the same. To demonstrate the reaction we use the simplest form of hydrocarbon: Methane (CH<sub>4</sub>)  
Other related Hydrocarbons are: Pentane (C<sub>5</sub>H<sub>12</sub>) refined becomes Octane or petrol (C<sub>8</sub>H<sub>18</sub>) Nonane (C<sub>9</sub>H<sub>20</sub>) refined to hexadecane or diesel fuel (C<sub>16</sub>H<sub>34</sub>) Butane (C<sub>4</sub>H<sub>10</sub>) For example: C<sub>8</sub>H<sub>18</sub> + 12.5 O<sub>2</sub> -> 8 CO<sub>2</sub> + 9 H<sub>2</sub>O  
The cycloalkanes, are saturated hydrocarbons which have one or more carbon rings to which hydrogen atoms are attached according to the formula C<sub>n</sub>H<sub>2n</sub>  
The aromatic hydrocarbons are unsaturated hydrocarbons which have one or more planar six-carbon rings called benzene rings, to which hydrogen atoms are attached with the formula C<sub>n</sub>H<sub>n</sub>.

CO<sub>2</sub> Paradox



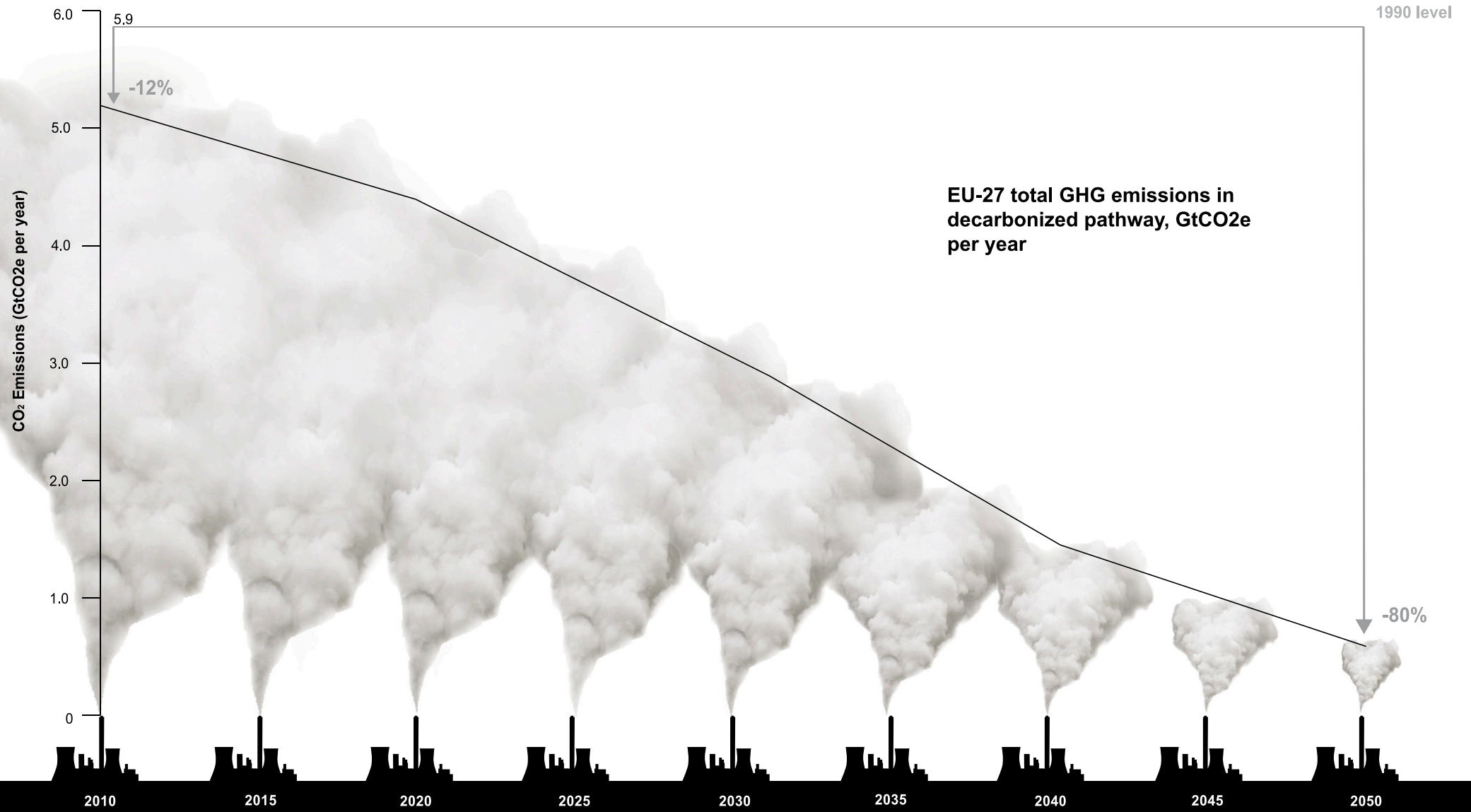
(A SIMPLE HYDROCARBON REACTION TO ILLUSTRATE WHAT HAPPENS WHEN 1 CARBON MOLECULE BONDS WITH 2 OXGEN MOLECULES TO BECOME CO2 IT'S MOLECULAR WEIGHT INC

PERIODIC ARRANGEMENT OF THE ELEMENTS — MENDELEJEFF'S

SERIES	ZERO GROUP	GROUP I R <sub>2</sub> O	GROUP II RO	GROUP III R <sub>2</sub> O <sub>3</sub>	GROUP IV R <sub>2</sub> O <sub>3</sub>	GROUP V R <sub>2</sub> O <sub>3</sub>	GROUP VI RO <sub>2</sub> RH <sub>2</sub>	GROUP VII R <sub>2</sub> O <sub>2</sub> RH	GROUP VIII R <sub>2</sub> O <sub>2</sub>
0		Hydrogen H = 1.008							
1				Boron B = 11.0	Carbon C = 12.00	Nitrogen N = 14.01	Oxygen O = 16.00	Fluorine F = 19.0	
2	Helium He = 4.00	Lithium Li = 6.94	Glucium (Beryllium) Gl = 9.1	Aluminum Al = 27.1	Silicon Si = 28.3	Phosphorus P = 31.04	Sulphur S = 32.06	Chlorine Cl = 35.46	
3	Neon Ne = 20.2	Sodium Na = 23.00	Magnesium Mg = 24.32	Scandium Sc = 44.1	Titanium Ti = 48.1	Vanadium V = 51.0	Chromium Cr = 52.0	Manganese Mn = 54.93	Iron Fe = 55.84
4	Argon A = 39.88	Potassium K = 39.10	Calcium Ca = 40.07	Zinc Zn = 65.37	Gallium Ga = 69.9	Germanium Ge = 72.5	Selenium Se = 79.2	Bromine Br = 79.92	Cobalt Co = 58.9
5		Copper Cu = 63.57	Strontium Sr = 87.63	Yttrium Yt = 88.7	Zirconium Zr = 90.6	Arsenic As = 74.96	Molybdenum Mo = 96.0	Ruthenium Ru = 101.7	Rhodium Rh = 101.1
6	Krypton Kr = 82.92	Rubidium Rb = 85.45	Cadmium Cd = 112.40	Indium In = 114.8	Tin Sn = 118.7	Antimony Sb = 120.2	Tellurium Te = 127.5	Iodine I = 126.92	
7		Silver Ag = 107.88	Barium Ba = 137.37	Lanthanum La = 139.0	Cerium Ce = 140.25	Praesodymium Pr = 140.9	Neodymium Nd = 144.3	Erbium Er = 167.7	Osmium Os = 190.9
8	Xenon Xe = 130.2	Caesium Cs = 132.81		Gadolinium Gd = 157.3	Terbium Tb = 159.2	Tantalum Ta = 181.5	Tungsten W = 184.0		Iridium Ir = 192.2
9		Samarium Sa = 160.4		Ytterbium (Neoytterbium) Yb = 173.5	Lead Pb = 207.2	Bismuth Bi = 208.0			
10		Thallium Tl = 168.5		Thalium Tl = 204.0	Thorium Th = 232.4				
11		Gold Au = 197.2		Mercury Hg = 200.6					
12		Radium Ra = 226.0							
12	Niton Nt = 222.4								

# CO2 EMISSIONS NEED TO BE REDUCED 80% BY 2050

CO2 Emissions in Decarbonized EU

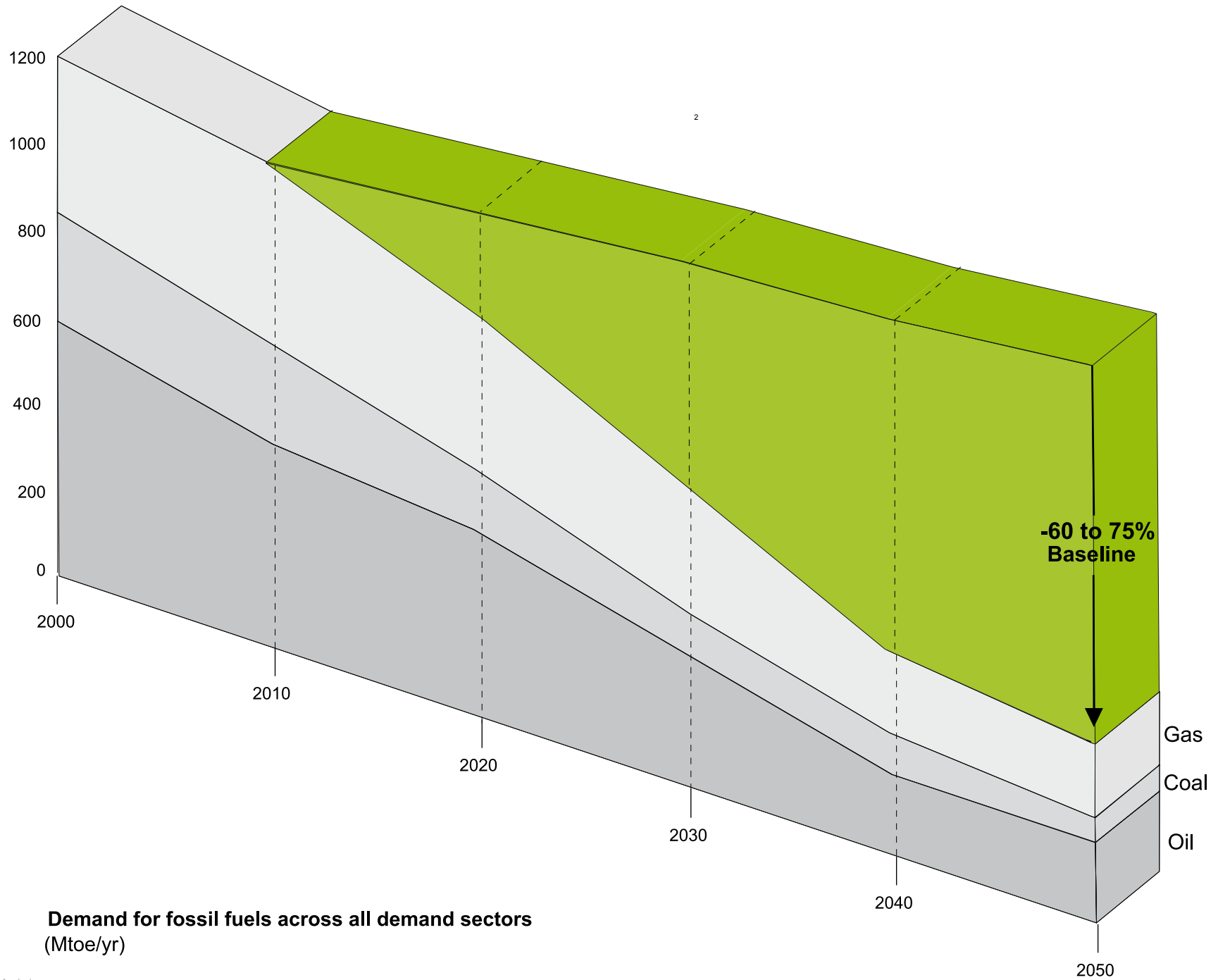


Note: In pathways: CCS retrofit of coal plants built from 2011 to 2020 is performed 2021-2030; After 2020 only new build fossil plants with CCS

SOURCE: Roadmap 2050 Technical Analysis

# FOSSIL FUEL DEMAND DECREASES SIGNIFICANTLY

By 2050 fossil fuel demand for power generation decreases across all sectors/



Demand for fossil fuels across all demand sectors (Mtoe/yr)

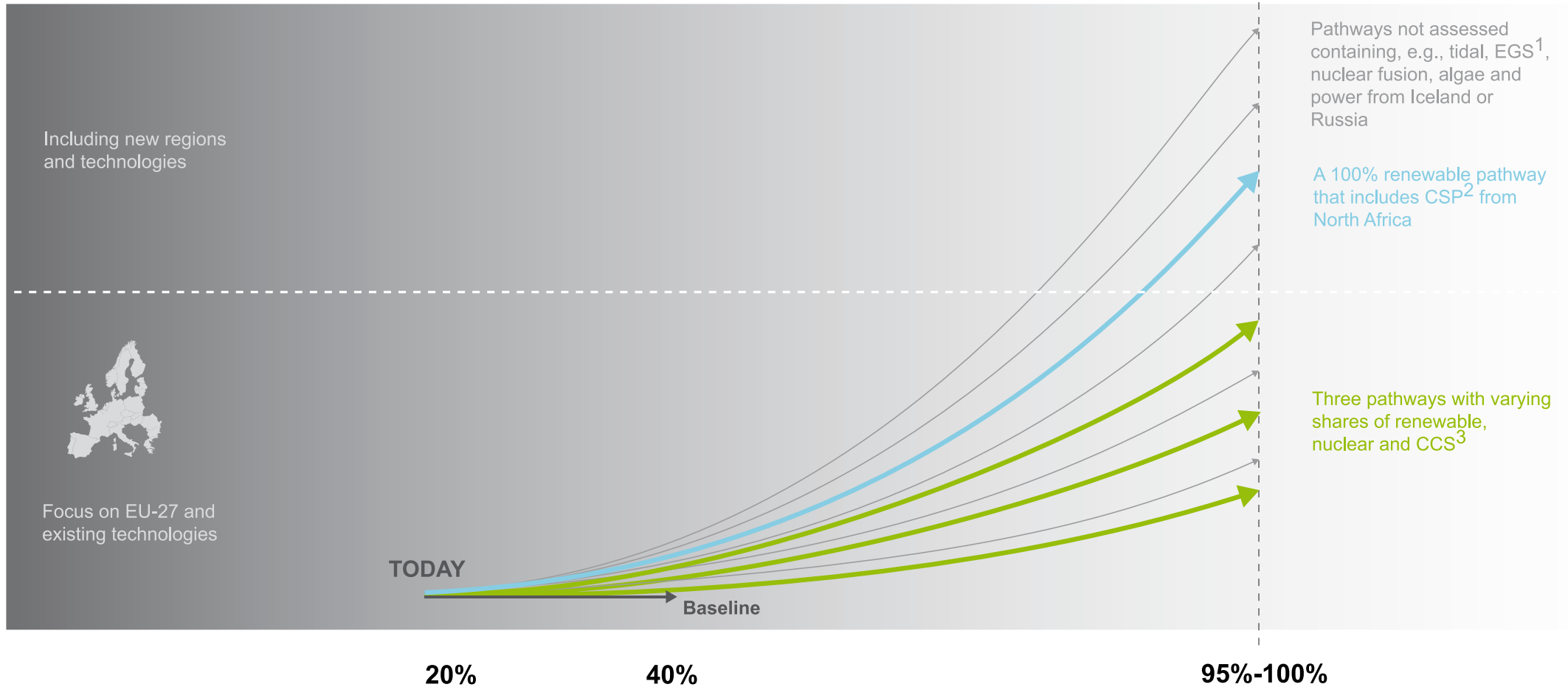
SOURCE: Roadmap 2050 Technical Analysis

Fossil Fuel Demand Decreases

# MANY PATHWAYS COULD LEAD TO ZERO CARBON POWER

EACH OF THE MODELLED PATHWAYS CONTAINS A DIFFERENT MIX OF RENEWABLE ENERGY SOURCES, CCS AND NUCLEAR, BUT EACH LEAD TO A ZERO CARBON POWER SECTOR.

Decarbonization Pathways



Power sector decarbonization

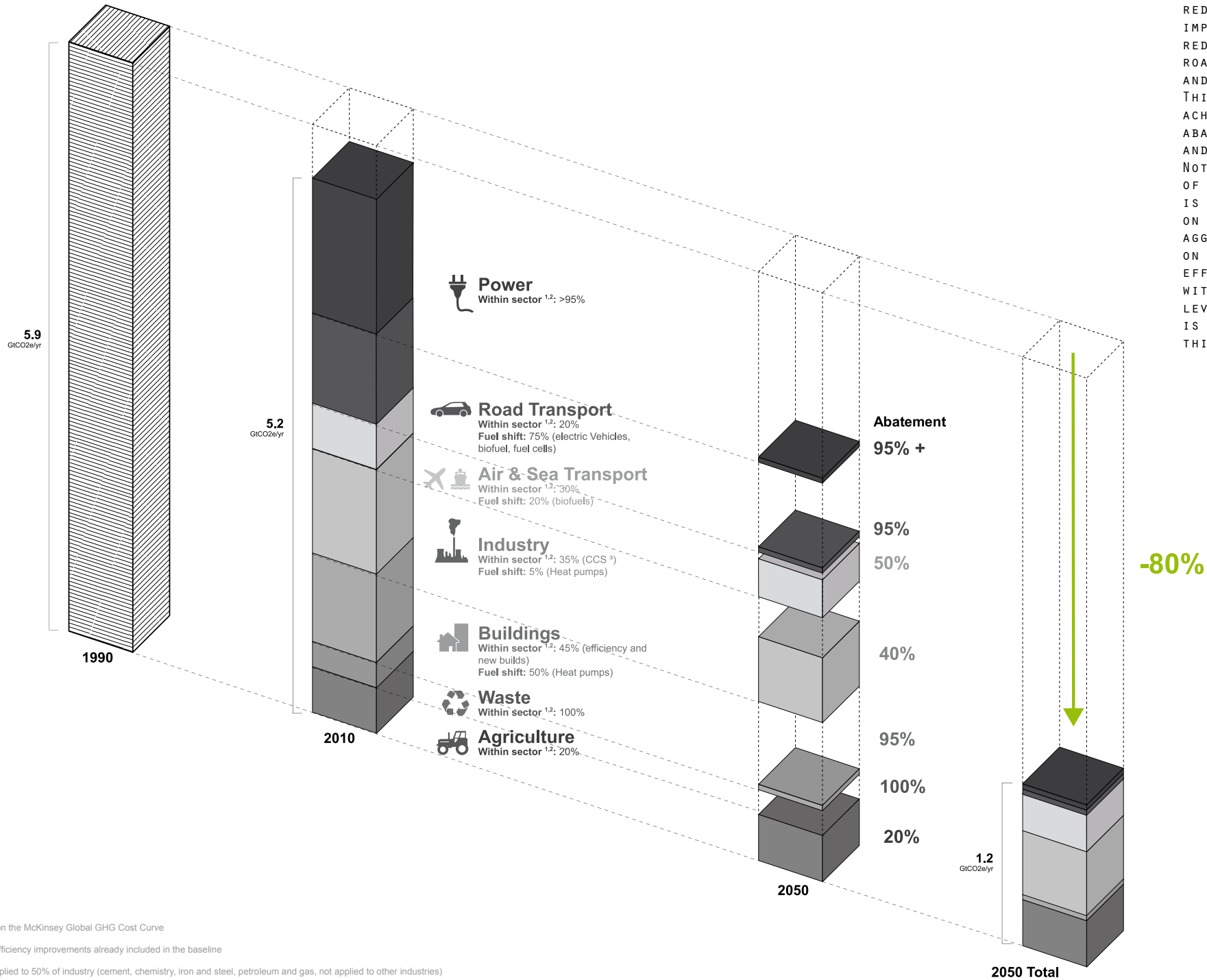
Decarbonized power

1) Enhanced Geothermal Systems  
 2) Concentrated Solar Power (thermal, not photo voltaic)  
 3) Carbon Capture and Storage

SOURCE: Roadmap 2050 Technical Analysis

# 80% CO2 EMISSION REDUCTION

80% CO2 Reduction



THE 80% CO<sub>2</sub> REDUCTION OVERALL IMPLIES 90-95% REDUCTION IN POWER, ROAD TRANSPORT AND BUILDINGS. THIS COULD BE ACHIEVED BY MAXIMUM ABATEMENT WITHIN AND ACROSS SECTORS. NOTE: THIS LEVEL OF DECARBONIZATION IS DEPENDENT ON ACHIEVING AGGRESSIVE 2% YEAR ON YEAR ENERGY EFFICIENCY SAVINGS, WITHOUT WHICH THIS LEVEL OF ABATEMENT IS NOT POSSIBLE IN THIS MODEL.

1 Based on the McKinsey Global GHG Cost Curve

2 Large efficiency improvements already included in the baseline

3 CCS applied to 50% of industry (cement, chemistry, iron and steel, petroleum and gas, not applied to other industries)

SOURCE: McKinsey Global GHG Abatement Cost Curve; IEA WEO 2009; US EPA; EEA; Roadmap 2050 Technical Analysis

# INTER-REGIONAL TRANSMISSION REQUIREMENTS

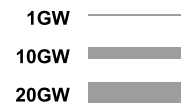
COMPARED TO CURRENT TRANSMISSION INFRASTRUCTURE, THE REQUIREMENTS FOR TRANSMISSION CAPACITY BETWEEN THE REGIONS DEFINED IN THE TECHNICAL REPORT ARE SIGNIFICANT.



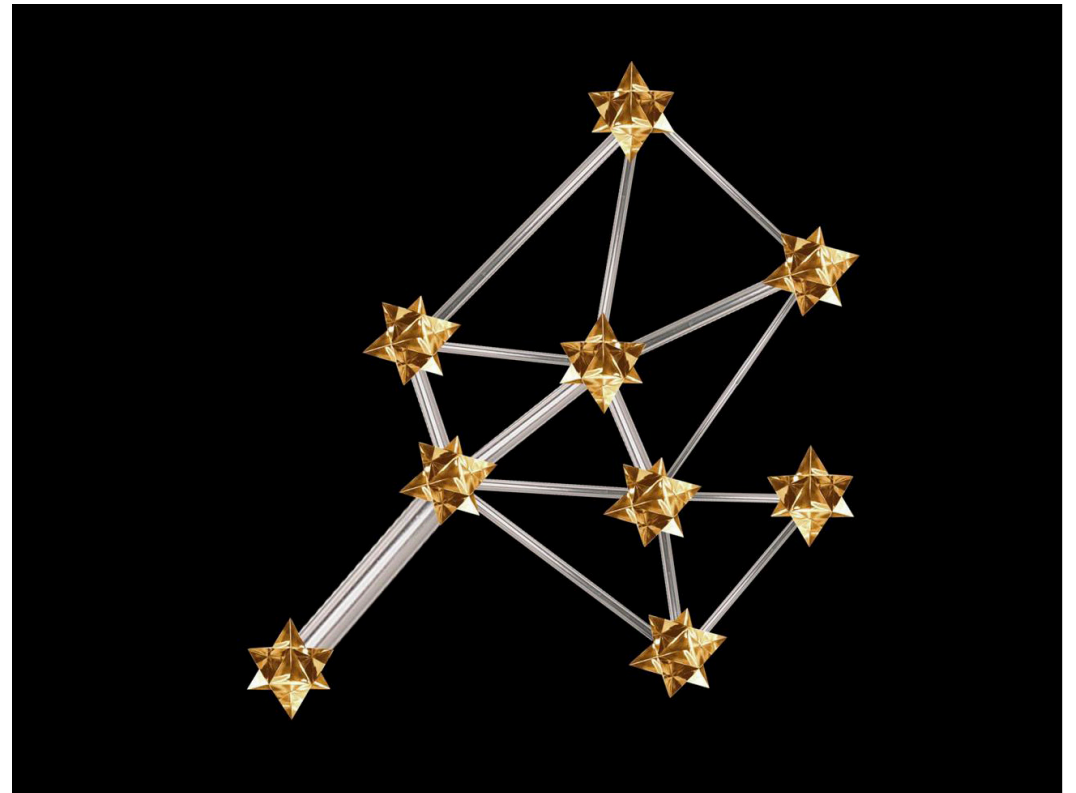
2010  
Existing Capacity



2050  
Total Transmission Requirements  
Assuming 80% RES & 20% DR<sup>1</sup>



<sup>1</sup> Demand response as used in this paper refers to changing a customer's electricity demand in response to dispatch instructions or price signals through communications technologies. In the Volume 1 analysis, it is assumed that any such changes retained the total energy consumed within the day, that is, moved or shifted demand rather than reduced total daily consumption.  
NOTE: Iberia-France link is challenging and maybe reduced by different solar/wind mix.  
SOURCE: Roadmap 2050 Technical Analysis









INTERVIEW\_\_

ALEXANDER LIKHOTAL  
ROTTERDAM\_GENEVA  
11 FEBRUARY 2010

**ALEXANDER LIKHOTAL**

PRESIDENT AND CEO OF GREEN CROSS INTERNATIONAL SINCE 1996. MR. LIKHOTAL STARTED HIS ACADEMIC CAREER AS A LECTURER AT THE MOSCOW STATE INSTITUTE FOR INTERNATIONAL AFFAIRS, AND LATER BECAME SENIOR RESEARCH FELLOW AT THE DIPLOMATIC ACADEMY OF THE MINISTRY OF FOREIGN AFFAIRS OF THE USSR. IN 1988 HE BECAME PROFESSOR OF POLITICAL SCIENCE AND INTERNATIONAL RELATIONS AT THE DIPLOMATIC ACADEMY.

DURING THE TIME OF GORBACHEV'S PERESTROIKA LIKHOTAL BECAME THE HEAD OF THE EUROPEAN SECURITY DESK AT THE INTERNATIONAL DEPARTMENT OF THE CENTRAL COMMITTEE FOR THE COMMUNIST PARTY OF THE SOVIET UNION, LATER BECOMING HEAD OF THE CONSULTANTS GROUP, ADVISER/SPEECHWRITER UNIT WORKING DIRECTLY FOR THE SOVIET LEADERSHIP.

IN 1991 MR. LIKHOTAL WAS APPOINTED DEPUTY SPOKESMAN AND ADVISER TO THE PRESIDENT OF THE USSR. HE REMAINED WITH PRESIDENT GORBACHEV AS HIS ADVISER AND SPOKESMAN AND WORKED AT THE GORBACHEV FOUNDATION AS THE INTERNATIONAL AND MEDIA DIRECTOR.

"HE WAS A VISITING PROFESSOR AT THE NORTHEASTERN UNIVERSITY, BOSTON, USA (1996-1998), RESEARCH ASSOCIATE AT THE INSTITUTE OF EUROPEAN STUDIES OF THE RUSSIAN ACADEMY OF SCIENCES IN MOSCOW (1992 - 1997), AND ASSOCIATE EDITOR OF SECURITY DIALOGUE JOURNAL, OSLO, NORWAY (1994-2000). HE IS THE AUTHOR OF SEVERAL BOOKS AND NUMEROUS ARTICLES.

**LAURA BAIRD**

OFFICE FOR METROPOLITAN ARCHITECTURE

**TANNER MERKELEY**

OFFICE FOR METROPOLITAN ARCHITECTURE

LB: THANK YOU FOR TAKING THE TIME TO MEET WITH US

AL: IT IS MY PLEASURE. I HAVE READ THE DOCUMENTS YOU SENT ME, QUITE AN INTERESTING PROJECT I MUST SAY.

LB: WE ARE GLAD YOU THINK SO.

(INTRODUCTIONS, ANNA SPEAKING IN RUSSIAN)

LB: MAYBE AS A LITTLE BIT OF BACKGROUND: WE INITIALLY HOPED TO APPROACH MR. GORBACHEV AND YOUR ORGANIZATION AFTER READING AN ARTICLE PUBLISHED IN THE UK TIMES IN NOVEMBER, WHICH ESSENTIALLY EQUATED THE INTERVENTION REQUIRED TO ADDRESS CLIMATE CHANGE TO THE ACTION THAT NEEDED TO BE TAKEN TO END THE COLD WAR. WE FELT IN SOME WAY WE HAVE ADDRESSED THIS THROUGH THIS PROJECT, AS OUR INITIAL INTEREST WAS PROMPTED BY OUR OBSERVATION THAT MANY OF THE INITIATIVES TAKEN TO ADDRESS SUSTAINABILITY HAVE NOT BEEN ON A LARGE ENOUGH SCALE TO MAKE MUCH OF A DIFFERENCE.

WHAT INTERESTED US ABOUT GREEN CROSS INTERNATIONAL SPECIFICALLY WAS THE FACT THAT YOUR IDEALS (SECURITY, POVERTY AND THE ENVIRONMENT) ARE NOT ONLY UNDER ONE UMBRELLA, BUT ALSO ADDRESSED IN A SINGLE RESPONSE SYSTEM. ONE OF OUR AMBITIONS FOR THIS PROJECT IS TO COMBINE THE IDEALS WHICH YOU HAVE COMBINED IN YOUR ORGANIZATION; AS A RESULT, WE WERE HOPING TO TALK TO YOU ABOUT SOME OF YOUR SUCCESSES AND SOME OF THE WAYS THAT YOU HAVE BEEN ABLE TO DO THAT EFFECTIVELY, AND WOULD LIKE TO INCORPORATE SOME OF THE IDEALS AND YOUR STRATEGIES INTO OUR PROJECT PROPOSAL.

TM: IN ADDITION, WE HAVE NOTICED THAT YOU SPEAK A LOT ABOUT MOTIVATING LEADERS TO TAKE ACTION. WE HAVE A VERY INTERESTING POSITION AT THE MOMENT, TO REACH-OUT TO POLITICAL LEADERS TO OFFER THEM A FEASIBLE APPROACH TO REACHING THE TARGETS THEY HAVE SET. ONE OF THE PRIMARY PURPOSES OF THIS REPORT IS TO INSPIRE ACTION. IF YOU HAVE SOME INTERESTING THOUGHTS OR EXPERIENCES IN THIS AREA, YOUR INSIGHT WOULD BE A GREAT HELP.

AL: THANK YOU VERY MUCH. I WILL JUST GIVE YOU A VERY BRIEF DESCRIPTION OF OUR ACTIVITIES.

FIRST, WE HAVE CREATED THE TASK FORCE ON CLIMATE CHANGE, IT IS LOGISTICALLY SUPPORTED BY GCI (GREEN CROSS INTERNATIONAL) BUT IT INVOLVES THE CONTRIBUTION AND WORK WE HAVE DONE THROUGH COOPERATING WITH A NUMBER OF INTERNATIONAL ORGANIZATIONS, SUCH AS: THE CLUB OF ROME, CLUB OF MADRID, THE EUROPEAN CLIMATE FOUNDATION AND VARIOUS NOBEL PEACE LAUREATES.

SO, I THINK THAT THE EFFORTS TODAY ARE VERY MUCH SPLIT TOWARD THE GOALS OF THE CLIMATE AGENDA. FOR INSTANCE, WHAT WE ARE TRYING TO DO IS NOT TO RE-CREATE THE BICYCLE, BUT TO CONSOLIDATE WHAT IS AVAILABLE TODAY AND TO TRY TO MAKE IT AVAILABLE FOR THE LEADERS OF STATES SO THAT THEY CAN TAKE MORE EDUCATED CHOICES IN THEIR DECISIONS.

AT THE SAME TIME, AFTER COPENHAGEN IT IS CLEAR THAT WE HAVE TO

ADJUST SOME OF OUR ACTIVITIES. AS YOU KNOW WE HAVE LEARNED A COUPLE OF LESSONS FROM COPENHAGEN AND WE ADJUST NOW IN THIS TRANSITION PHASE. FOR INSTANCE, IT IS CLEAR THAT IT IS NOT NECESSARY ANYMORE TO TRY TO RAISE AWARENESS OF THE LEADERS OF THE STATES OF CLIMATE ISSUES. THE AWARENESS IS THERE, AS EVIDENCED BY THE FACT THAT OVER 100 LEADERS CAME TO COPENHAGEN SHOWS THAT THEY ARE AWARE OF THE PROBLEMS AT STAKE.

THE PROBLEMS ARE MUCH DEEPER, AND THE PROBLEMS ARE MORE RELATED TO THE FACT THAT CLIMATE CHANGE IS JUST THE TIP OF AN ICEBERG. IN REALITY, WHEN WE ARE TALKING ABOUT CLIMATE CHANGE, IT IS NOT JUST A CONVERSATION ABOUT THE 2 DEGREES OR ONE HALF DEGREES, HOWEVER IMPORTANT THIS MIGHT BE FOR CLIMATOLOGISTS. FOR US THE PROBLEM IS ROOTED IN POVERTY, IN LACK OF SECURITY IN TODAY'S WORLD, IN THE PROBLEMS OF UNFAIR SPREAD OF ENERGY, THE PROBLEMS OF WATER. ACTUALLY WE ARE TALKING ABOUT THE MILLENNIUM DEVELOPMENT GOALS, WHICH WILL BE THE MOST DRAMATIC DEMONSTRATION OF THE CHALLENGES WE FACE TODAY.

SO, COPENHAGEN ALSO DEMONSTRATED THAT WHATEVER WAS DECIDED OR NOT DECIDED, THE CHANGE WILL COME REGARDLESS, SIMPLY BECAUSE THE ECONOMIC, GEOPOLITICAL AND SECURITY CONSIDERATIONS ALREADY PROMPT CHANGE IN THIS DIRECTION. THE PROBLEM FIRST OF ALL IS THE COST THAT WILL PUSH THIS TRANSITION. OF COURSE IF THE GOVERNMENTS WILL GUIDE

COPENHAGEN ALSO DEMONSTRATED THAT WHATEVER WAS DECIDED OR NOT DECIDED, THE CHANGE WILL COME REGARDLESS, SIMPLY BECAUSE THE ECONOMIC, GEOPOLITICAL AND SECURITY CONSIDERATIONS ALREADY PROMPT CHANGE IN THIS DIRECTION.

THIS TRANSITION, BUT IF LEADERS GUIDE THIS TRANSITION, IT WILL BE SMOOTHER, LESS PAINFUL AND EASIER FOR EVERYBODY.

LB: UNTIL NOW, THE TECHNICAL ANALYSIS OF OUR PROJECT HAS AIMED TO SHOW LEADERS THAT INDEED IT IS TECHNICALLY FEASIBLE TO PROPOSE A DE-CARBONIZED POWER SECTOR BY 2050. FROM A COST STANDPOINT WE CAN PROVE THAT WE HAVE A CERTAIN AMOUNT OF FEASIBILITY. WE HAVE A THOROUGH ANALYSIS TO SHOW THIS TO THE LEADERS AND WE ARE QUITE CONFIDENT IN THE CONCLUSION. HOWEVER, ONE THING YOU HAVE DISCUSSED THAT WE WOULD LIKE TO KNOW MORE ABOUT: IS YOUR APPEAL TO MAKE THE PUBLIC MORE AWARE AND MOTIVATED TO SUPPORT THIS KIND OF PROPOSAL. HOW DO YOU REALLY RALLY PUBLIC INVOLVEMENT AND CREATE DESIRE TO DO SOMETHING BEYOND TALKING ABOUT IT. WE WOULD LIKE TO HAVE YOUR INPUT AND WOULD LIKE TO HEAR ABOUT YOUR PERSONAL SUCCESS IN THIS AREA. TO US THIS REMAINS A VERY IMPORTANT

IT IS NOT NECESSARY ANYMORE TO TRY TO RAISE AWARENESS OF THE LEADERS OF THE STATES OF CLIMATE ISSUES. THE AWARENESS IS THERE.

COMPONENT IN THE PROJECT.

AL: ACTUALLY, THE TASK FORCE WAS CREATED ONLY IN THE LAST 10 MONTHS, SO IT IS QUITE A NEW ORGANIZATION. OF COURSE THE TIMING WAS NOT SUFFICIENT TO DO ALL THAT WE WANTED BEFORE COPENHAGEN, ALTHOUGH WE TRIED: WE'VE BUILT UP THE WEB PRESENCE AND USED ALL THE SOCIAL NETWORKS AS WE CAN. WE ALSO LAUNCHED PUBLICLY ON THE FIRST DAY OF COPENHAGEN. WE ARE THINKING HOW WE CAN DEVELOP AND TALKING TO A NUMBER OF INTERNATIONAL COMPANIES, INCLUDING WIKIPEDIA AND GOOGLE, THINKING HOW WE CAN ENHANCE OUR PRESENCE AND OUTREACH BUT AT THE SAME TIME, I THINK WE SHOULD THINK ABOUT THE CONTENT.

WE ARE SCARED GENERALLY, BECAUSE THE EFFORTS TO RAISE AWARENESS WERE BUILT ON A PLATFORM TO SHOW THE DRAMATIC CONSEQUENCES OF CLIMATE CHANGE, AND SOMETIMES IT WAS COUNTER-PRODUCTIVE. PRESIDENT CLINTON

'CLIMATE CHANGE SHOULD BE SEEN AS AN OPPORTUNITY, AND NOT AS A CASTOR OIL WHICH NEEDS TO BE SWALLOWED.'

RECENTLY SAID (ABSOLUTELY CORRECTLY) THAT: 'CLIMATE CHANGE SHOULD BE SEEN AS AN OPPORTUNITY, AND NOT AS A CASTOR OIL WHICH NEEDS TO BE SWALLOWED.' I AGREE COMPLETELY, ESPECIALLY AFTER WHAT IS PRESENTED IN THE MEDIA AS CLIMATE-GATE, ETC... I THINK THAT WE SHOULD CONCENTRATE ON THE OPPORTUNITIES PRESENTED BY OUR CURRENT SITUATION, AND THE NECESSITY RELATED TO OTHER ISSUES BECAUSE OF CLIMATE CHANGE.

AS AN EXAMPLE, JUST TEN DAYS AGO I WAS IN LEBANON, AND WITHIN THE AGENDA OF

THE CLIMATE TASK FORCE WE HAD A MEETING WITH THE PRESIDENT AND THE PRIME MINISTER OF LEBANON DISCUSSING THIS AGENDA. DURING MY TIME THERE I ALSO HAD A NUMBER OF MEETINGS WITH COMPANIES RELATED TO THE DISTRIBUTION OF ENERGY. LEBANON WHICH IS DEPENDENT ON 97% INPUT OF ITS ENERGY, OF COURSE, ENORMOUSLY SUPPORTS THE SWITCH TO RENEWABLE ENERGY BECAUSE THE FINANCIAL BURDEN OF IMPORTING ENERGY IS VAST. HOWEVER AT THE SAME TIME, I LEARNED A NUMBER OF INTERESTING THINGS, SOME OF WHICH MIGHT BE RELEVANT TO YOU. ONE PERSON COMPLAINED THAT HE WANTED TO BUY A TOYOTA PRIUS (HYBRID PETROL-ELECTRIC CAR) UNFORTUNATELY IN LEBANON A CERTAIN TYPE OF LEGISLATION EXISTS WHERE THE PERSON HAS TO PAY AN ENGINE TAX AND SINCE THE CAR HAS TWO ENGINES THEY ARE TAXED FOR BOTH ENGINES. WHEN I TOLD HIM THAT IN SWITZERLAND FOR INSTANCE PEOPLE ARE ENCOURAGED TO BUY HYBRID CARS SO THEY DO NOT HAVE TO PAY ANY TAX AT ALL WHEN THEY BUY A HYBRID CAR, HE SAID: "WOW!"

THE FINANCIAL BURDEN OF IMPORTING ENERGY IS VAST.

I WANT TO JUMP BACK TO YOUR REPORT; I READ IT WITH A LOT OF INTEREST, AND I THINK IT IS A STEP IN THE RIGHT DIRECTION. HOWEVER, I WOULD HAVE TRIED TO MAKE IT A LITTLE BIT LESS EUROCENTRIC. YOU SEE WHEN WE ARE TALKING ABOUT CLIMATE CHANGE ABOUT THE NECESSITY OF THE ENERGY SWITCH TO THE GREEN SPHERE. IT IS NOT ONLY A QUESTION OF HOW MUCH CO2 WE EMIT TO THE ATMOSPHERE IT IS ALSO THE QUESTION THAT

LOTS OF PEOPLE AROUND THE WORLD LIVE WITHOUT ANY ACCESS TO ENERGY. WITHOUT RESOLVING ACCESS TO ENERGY WITHIN THE FRAMEWORK OF THE DEVELOPMENT OF THE GRID, WE WILL STILL FIND OURSELVES WITH THE SAME CHALLENGES, WITH THE SAME NET RESULT. YOU ARE ABSOLUTELY CORRECT IN TALKING ABOUT THE NECESSITY TO EXPAND THE RENEWABLE ENERGY NETWORK, BUT IN TALKING ABOUT NORTH AFRICAN COUNTRIES YOU ARE TALKING MAINLY ABOUT SUPPLIERS OF ENERGY, AND YOU COULD ALSO SPEAK TO WHAT THESE COUNTRIES, PERHAPS SUB-SAHARAN COUNTRIES WILL GET IN RETURN FOR THIS COLLABORATION. THESE ISSUES ARE EQUALLY IMPORTANT WHEN DISCUSSING

TACKLING CLIMATE CHANGE ON A GLOBAL LEVEL IS EXTREMELY CHALLENGING, IF NOT IMPOSSIBLE.

YOU MADE 'THERE ARE TOO MANY COMPETING INTERESTS BETWEEN PARTIES TO COME TO AN AGREEMENT ON A GLOBAL LEVEL.' WHAT WE ARE TRYING TO DO IS ADDRESS THIS ON A REGIONAL SCALE FIRST, INSTEAD OF A STATE SCALE WHICH HAS ALSO NOT WORKED, OR ON A GLOBAL SCALE WHICH IS EXTREMELY COMPLEX. THE AMBITION THAT WE HAVE AND WOULD LIKE TO SEE HAPPEN, IS TO START BY PROVING IT IS TECHNICALLY FEASIBLE ON A REGIONAL SCALE, AND EVENTUALLY ALL THE NETWORKS WOULD TAP INTO A MUTUALLY BENEFICIAL SYSTEM. I DO STRONGLY AGREE WITH YOU THAT CLIMATE ISSUES KNOW NO BOARDERS AND ARE INHERENTLY A GLOBAL PROBLEM. NEVERTHELESS, TO BEGIN WE ARE TRYING TO APPROACH THIS PROBLEM ON A MORE MANAGEABLE LEVEL AND TRY TO SET A GLOBAL EXAMPLE THAT A LOW-CARBON WESTERN SOCIETY IS POSSIBLE.

AL: I UNDERSTAND VERY WELL, TALKING ABOUT A ROADMAP, MAPS ALWAYS CHART UNCERTAIN TERRAIN SO THIS IS VERY APPROPRIATE. IN THIS CASE YOU ARE TALKING ABOUT A LOW-CARBON EUROPE, SO THAT IS CLEAR THAT THE GENERAL CONNOTATION OF THIS MAP WILL FOCUS PRIMARILY ON THE EUROPEAN CONDITION.

AL: YOU ARE ALSO TALKING ABOUT THE POSSIBILITY TO HAVE A PRESENTATION OF YOUR MATERIAL TO EUROPEAN LEADERS AND THAT IS VERY IMPORTANT. WE HAVE ALREADY HAD A COUPLE OF MEETINGS WITH LEADERS ON OUR SIDE OF EUROPE; OF COURSE EUROPE

CAN PAVE THE WAY AND SHOW THE EXAMPLE TO THE REST OF THE WORLD AND THE EUROPEANS HAVE ALREADY MADE SIGNIFICANT STEPS IN A POSITIVE DIRECTION. IF I UNDERSTAND YOUR REPORT CORRECTLY, APPROXIMATELY 15% OF THE ENERGY IN EUROPE IS BASED ON RENEWABLE ENERGY. MANY COUNTRIES STILL HAVE THE GOAL TO EVEN REACH 15%! AGAIN, IT IS A MATTER OF FACILITATION. FOR INSTANCE THE FIGURES THEY SHOW IN THE US UNTIL 2007 STATE THAT OVER ONE TRILLION DOLLARS HAVE BEEN INVESTED

ENERGY NETWORKS.

LB: INTERESTING; THE EUROCENTRIC POSITION IS TO START HERE, AND HOPEFULLY EXPAND OR EXPORT THE MODEL. ONE OF THE REASONS FOR IT BEING EUROCENTRIC IS THE FAILURE OF COPENHAGEN HAS MADE IT APPARENT THAT TACKLING CLIMATE CHANGE ON A GLOBAL LEVEL IS EXTREMELY CHALLENGING, IF NOT IMPOSSIBLE. TO PARAPHRASE A COMMENTARY

'AT A PRICE HIGHER THAN 70 DOLLARS PER BARREL FOR OIL, WIND ENERGY BECOMES VERY COMPETITIVE.'

IN RENEWABLE ENERGY. SIMILARLY THE PRICE OF WIND ENERGY HAS DROPPED 80% IN THE LAST FIVE YEARS IN EUROPE. RECENTLY I WAS QUITE SURPRISED TO SPEAK TO ONE OF MY CONTACTS WHO IS AN INFLUENTIAL INVESTOR. HE USUALLY HAS LITTLE INTEREST IN ENVIRONMENTAL THINKING, BUT RECENTLY I HAVE LEARNED THAT HE IS TRYING TO CREATE A PROJECT TO BUILD THE LARGEST WIND POWER STATION IN EUROPE, WHICH WOULD GENERATE 5.5 THOUSAND MEGAWATTS, AND WHEN I ASKED HIM WHY? HIS ANSWER WAS VERY CLEAR: 'AT A PRICE HIGHER THAN 70 DOLLARS PER BARREL FOR OIL, WIND ENERGY BECOMES VERY COMPETITIVE.'

IT IS VERY IMPORTANT TO REDUCE THE SUBSIDIES AND TO ADJUST THE CARBON PRICE SO THAT BUSINESS WILL BE MUCH MORE EAGER TO RESPOND TO GREEN ENERGY.

TM: EXACTLY, WHEN YOU LOOK AT THE NUMBERS, AND COMPARE THEM TO THE FUTURE SUPPLY AND DEMAND OF OIL, PRICES WILL CONTINUE TO INCREASE, SO FORWARD THINKING INVESTORS WHO ESTABLISH A SHARE OF THE MARKET EARLY WILL POTENTIALLY BENEFIT THE MOST IN THE LONG RUN.

LB: ONE OF THE OTHER QUESTIONS WE HAD WAS RELATING TO GIVING PEOPLE INCENTIVES. FOR INSTANCE: ON A EUROPEAN OR GLOBAL SCALE THERE IS A DEGREE OF AWARENESS AND THERE IS A NEED FOR ACTION, BUT BEYOND THE RECOMMENDATION OF NOT TAXING ELECTRIC VEHICLES, DO YOU HAVE SOME OTHER INCENTIVES FOR EITHER DEVELOPED OR NON-DEVELOPED NATIONS TO SUPPORT REDUCING OUR DEPENDENCE ON FOSSIL FUEL.

AL: THERE ARE SEVERAL THINGS WORTH MENTIONING IN THIS CONTEXT: FIRST, I WOULD TALK ABOUT THE BIGGEST CHALLENGES. IT WAS ALREADY DEALT WITH BY THE G20, BUT THEY PUT IT ON THE 'MEDIUM' RANGE STRATEGY, SO IT IS NOT YET CLEAR WHEN THE PRACTICAL STEPS WILL BE TAKEN IN THIS DIRECTION, AND WHAT THE STEPS WILL BE. THEN, AS COPENHAGEN SHOWED GOVERNMENTS WILL RATHER FOLLOW THE PRACTICAL DEVELOPMENTS IN THAT SPHERE THAN PAVE THE WAY TO THAT.

IN THAT CONTEXT I THINK THAT IT IS VERY IMPORTANT TO REDUCE THE SUBSIDIES AND TO ADJUST THE CARBON PRICE SO THAT BUSINESS WILL BE MUCH MORE EAGER TO RESPOND TO GREEN ENERGY. THIS WILL INFLUENCE EVERYBODY, AND THERE EXISTS TREMENDOUS POTENTIAL FOR THIS IN THE MIDDLE-EAST AND GULF REGION. TODAY PLACES LIKE SAUDI ARABIA & THE EMIRATES ARE DOING SOME THINGS WITH RENEWABLE ENERGY, BUT I SUSPECT THE POSSIBILITY AND POTENTIAL TO MOTIVATE THE MIDDLE-EAST TO EXPAND THEIR RENEWABLE ENERGY CAPACITY IS ENORMOUS.

OF COURSE COOPERATING WITH OTHER COUNTRIES AND INITIATIVES HAS TREMENDOUS POTENTIAL. I REMEMBER AT SOME POINT THERE WAS A PROJECT CALLED DESERTEC, BUT UNFORTUNATELY I HAVE NOT HEARD MUCH ABOUT IT AFTER THEIR MUCH ACCLAIMED ANNOUNCEMENT OF COMPANIES JOINING AND

I SUSPECT THE POSSIBILITY AND POTENTIAL TO MOTIVATE THE MIDDLE-EAST TO EXPAND THEIR RENEWABLE ENERGY CAPACITY IS ENORMOUS.

THEIR SUCCESS, ETC... MAYBE IT IS IN THE PHASE OF DEVELOPMENT OR MAYBE THE CRISIS HAS STALLED THE PROJECT.

BUT GENERALLY, THE IDEA WAS QUITE INTERESTING. SIMPLY PUT, THE TRANSPORTATION OF ENERGY FROM AFRICA TO EUROPE IS VERY COMPETITIVE COMPARED TO THE DEVELOPMENT OF SOLAR ENERGY WITHIN EUROPE (MAKES REFERENCE TO CLOUDS IN GENEVA) SO IT DOES MAKE A LOT OF SENSE.

LB: SOME EXPERTS ESTIMATE THAT OVER \$300 BILLION IN SUBSIDIES ARE SLATED FOR OIL AND GAS AND ONLY \$10 BILLION SET ASIDE FOR RENEWABLE ENERGY. DO YOU THINK IT IS A MATTER OF GETTING TO GOVERNMENTS INSIDE AND OUTSIDE OF THE EU AND ASKING THAT THESE SUBSIDIES BE SLATED FOR RENEWABLE ENERGY? OR HOW DO YOU PROPOSE GOING ABOUT THAT?

GENERALLY, I THINK THERE ARE ONLY TWO WAYS OF OVERCOMING MARKET DISTORTION: THE FIRST IS THE PRICING OF CARBON AND THE SECOND IS THE CIVIL SOCIETY.

TM: ALSO ANOTHER POINT WE WANTED TO RAISE IS HOW DO YOU DEAL WITH THE SPECIAL INTEREST GROUPS THAT TEND TO MAKE 'SPECIAL ARRANGEMENTS' IN GOVERNMENT AND ULTIMATELY DISTORT ENERGY MARKET ECONOMICS?

AL: THIS IS ONE OF THE BIGGEST ISSUES I WOULD SAY. AGAIN RETURNING TO COPENHAGEN, IT IS CLEAR WHEN OBAMA CAME TO COPENHAGEN FULL OF EXPECTATION AND DRIVE. HE WAS A HOSTAGE TO DOMESTIC POLITICS, HE WAS A HOSTAGE TO THE BALANCE OF POWER IN CONGRESS, HE WAS A HOSTAGE TO THE FACT THAT CLIMATE CHANGE POLICY IS CLEARLY A PARTISAN ISSUE WITH DEMOCRATS ON ONE SIDE AND

REPUBLICANS ON THE OTHER. IT IS CLEAR THAT THE BILL WHICH IS NOW IN CONGRESS WILL BE DELAYED OPTIMISTICALLY UNTIL NEXT YEAR. GENERALLY, I THINK THERE ARE ONLY TWO WAYS OF OVERCOMING MARKET DISTORTION: THE FIRST IS THE PRICING OF CARBON AND THE SECOND IS THE CIVIL SOCIETY. THE FIRST WILL THEN FORCE BUSINESSES TO REORIENT AND TO THINK IN DIFFERENT TERMS AND THE SECOND WE NEED TO OUTREACH TO THE CIVIL SOCIETY NOT THROUGH DAY-AFTER STORIES (DOOMS-DAY) ABOUT CLIMATE CHANGE, BUT ABOUT THE REALITY OF HOW MUCH THEY ACTUALLY PAY TO FUEL A CAR AND THE PRICE OF SUBSIDIES THAT ALTER THE MARKET.

LB: WE HAVE BEEN IMPRESSED WITH YOUR ABILITY TO INFLUENCE AND INFORM THE INTERNATIONAL COMMUNITY TO VIEW HUMAN AND ENVIRONMENTAL TRAGEDIES WITH EQUAL IMPORTANCE. HOW WOULD YOU PRESENT INCENTIVES SIMILAR TO THE SUGGESTION YOU JUST MADE ABOUT CONVINCING POLITICIANS OR THE CIVIL SOCIETY OF THE PRICING OF FUEL. I AGREE THAT TELLING THE PUBLIC "IF WE DON'T DO SOMETHING WE ARE ALL GOING TO DIE" THIS IS NOT A VERY INSPIRING WAY TO ADDRESS THE ISSUE. I WAS WONDERING WHAT OTHER SUCCESS YOU HAVE HAD WITH PROMOTING CHANGE IN A POSITIVE LIGHT?

AL: WELL IT IS OF COURSE VERY DIFFICULT TO OUTLINE IN A VERY BRIEF CONVERSATION OF THIS SUBSTANCE, ESPECIALLY GIVEN TO DATE IT WILL BE A VERY UPHILL BATTLE, OF THE DECISIONS TO ALLOW THE COMPANIES TO SPEND WHATEVER THEY WANT ON THE POLITICAL CAMPAIGNS. THIS YEAR IN

THE USA THE FORECAST THAT THE EXPENDITURES OF THE COUNTER CLIMATE CHANGE PROPAGANDA WILL BE 50% MORE THAN LAST YEAR. BUT IN GENERAL, I THINK PEOPLE GENERALLY ARE SMART. WHEN WE BUILT UP OUR WEB TOOL BEFORE AND DURING COPENHAGEN THERE WAS AN ENORMOUS RESPONSE TO THAT AND WHAT PEOPLE WERE SENDING, I MEAN THEIR COMMENTS AND FEED-BACK TO THE PUBLICATION. PEOPLE SHOWED QUITE A HIGH LEVEL OF UNDERSTANDING OF THE PROBLEM. I BELIEVE WHAT IS NEEDED IS EMPOWERING PEOPLE TODAY. AND IN EMPOWERING IT BRINGS US BACK TO THE ISSUE OF THE NATURE OF DEMOCRACY. TODAY ECONOMIC ACTIVITIES TRANSCEND NATIONAL BORDERS. ENVIRONMENTAL CHALLENGES IN GENERALLY THE SECURITY CHALLENGE THEY HAVE CHANGED COMPLETELY. IT IS NOT ANYMORE THE THREAT OF ANOTHER COUNTRY OR AN OPPONENT IN A TRADITIONAL SENSE OF VIEW. IT IS TOTALLY DIFFERENT AND IT ALSO TRANSCENDS THE BORDER OF THE COUNTRY.

DEMOCRACY AS THE MECHANISM WHICH GIVES THE PEOPLE THE POSSIBILITY TO HAVE A VERY IMPORTANT IMPACT ON THE DECISION MAKING PROCESS, REMAINS LOCKED INSIDE NATIONAL BORDERS. SO ONE OF THE POSSIBILITIES COULD BE IN USING THE NEW TECHNICAL MEANS THAT ARE AVAILABLE AND GIVING THE PEOPLE IF NOT THE FORMAL ABILITY TO INFLUENCE THE DECISION MAKERS. BUT AT LEAST WE MAKE THE DECISION MAKERS AWARE THAT THE OPPOSITION TO CERTAIN DECISIONS IS GROWING. FOR EXAMPLE, DURING COPENHAGEN WE UNFORTUNATELY DID NOT ACHIEVE THAT LEVEL OF WEB SOPHISTICATION, BUT WE EXPECTED THAT IF WE COULD HAVE BEEN ABLE TO SHOW EVERY SINGLE DAY OF COPENHAGEN, SAY FOR INSTANCE: THE WORST GOVERNMENTS THAT CREATED BLOCKS, DURING THE NEGOTIATIONS. FOR THIS ARGUMENT LET'S SAY THEY WERE RUSSIAN; THEN WE MIGHT RECRUIT 20,000 MESSAGES AND CHANNEL THEM INTO A DESIGNATED ADDRESS. I CAN ASSURE YOU THAT

EVEN FOR A NOT VERY ADVANCED DEMOCRACY AS RUSSIA IS TODAY, IF THE PRESIDENT WOULD HAVE LEARNED THAT 20,000 PEOPLE RAISE THE ISSUE WHY IS OUR GOVERNMENT CREATING PROBLEMS IN COPENHAGEN, HE WILL AT LEAST PICK UP THE PHONE AND CALL THE HEAD OF THE DELEGATION AND WILL SAY: 'LOOK I HAVE RECEIVED 20,000 ENQUIRIES AND SAY WHY?'

LB: YES OF COURSE! IT IS A VERY VALID POINT. I WAS ACTUALLY IN COPENHAGEN AND THAT WAS ONE OF THE MOST COMPELLING DEMONSTRATIONS OR VISUALIZATIONS OF WHAT WAS ACTUALLY HAPPENING, SO MUCH OF WHAT HAPPENS ON THE GOVERNMENTAL LEVEL AND WHAT HAPPENS ON THE LEVEL OF THE DELEGATES IS SO OPAQUE, AND YOU FEEL AS THOUGH THERE WAS NO ACCESS TO IT OR YOU COULD HEAR SOME OF THE NEGOTIATIONS OR YOU COULD AT LEAST HEAR WHAT WAS GOING ON BUT YOU DIDN'T HAVE THE ABILITY TO INFLUENCE IT. I THINK THAT IS A VERY IMPORTANT DISTINCTION TO MAKE, BECAUSE ANYONE WHO WANTS TO INVEST IN THE FUTURE OF YOUR COUNTRY, OR OF EU OR THE WORLD SHOULD HAVE SOME ABILITY TO INFLUENCE EVEN IN A VERY SMALL WAY OR AT LEAST FEEL LIKE YOU CAN MAKE A DIFFERENCE. SO, YES I AGREE THAT THE WEB IS A VERY IMPORTANT DEMOCRATIC TOOL TO EXPLORE MORE EFFECTIVELY.

ONE OF THE POSSIBILITIES COULD BE IN USING THE NEW TECHNICAL MEANS THAT ARE AVAILABLE AND GIVING THE PEOPLE THE FORMAL ABILITY TO INFLUENCE THE DECISION MAKERS.

AL: JUST ONE SMALL OBSERVATION SINCE I MENTIONED RUSSIA. I WANTED TO SHARE SOME OF THE THOUGHTS THAT I HAD WHILE READING YOUR PAPERS. FOR THE SAKE OF THE CURRENT THREATS AND CURRENT, LET ME SAY FEELINGS IT'S VERY TRANSPARENT WHAT YOU ARE SAYING. SECURITY DICTATES TO BE INDEPENDENT FOR EUROPE IN TERMS OF ENERGY RESOURCES. I CAN TELL YOU THERE IS A SHORT TERM AND LONG TERM SECURITY CONSIDERATIONS THAT SHOULD BE TAKEN INTO ACCOUNT. WE HAD A MEETING WITH PRESIDENT DMITRY MEDVEDEV BEFORE WE WENT TO COPENHAGEN, AND ACTUALLY HE UNDERSTOOD THE PROBLEMS VERY WELL. WHAT MEDVEDEV SAID I CAN SUMMARIZE: 'YES WE UNDERSTAND THAT THIS TURN IS INEVITABLE, BUT FOR THE COUNTRIES THAT ARE NOT THAT DEPENDENT ON FOSSIL FUEL LIKE RUSSIA THIS CURVE WILL BE LESS STEEP THAN FOR THE REST OF THE WORLD.' SO IF YOU WOULD TRY TO BUILD A EUROPEAN NETWORK, AND EXCLUDE RUSSIA FROM THE PLANNING A FEW THINGS COULD HAPPEN. IN THE LONGER TERM FIRST IT WOULD MAKE THE CURVE FOR RUSSIA EVEN LESS STEEP BUT LATER IT WILL TAKE MUCH MORE TIME. AT THE END OF THE DAY THE PROBLEMS WILL PERSIST. I AM NOT SAYING THAT IT SHOULD NOT UNETHICALLY BECOME A PART OF THE CONSIDERATION; THE EUROPEAN UNION HAS AFTER ALL A VERY SPECIFIC AND CLEAR SPREAD OF, OR COMBINATIONS OF MEMBERSHIP NATIONS. AS YOU ARE TALKING ABOUT NORTH-AFRICAN POSSIBILITY OF EXPANSION OF THIS SYSTEM, PERHAPS YOU SHOULD LOOK INTO THE POSSIBILITY OF EXPANSION THAT COULD ALSO MOTIVATE RUSSIANS.

LB: DO YOU SEE THIS AS POTENTIAL TO BE ABLE TO DO THAT? AND IF SO IS THE POTENTIAL THERE? AND IF THERE HAS BEEN A HISTORY OF COLLABORATIONS THAT HAVE GONE WRONG OR HAVE BEEN FAR MORE DIFFICULT IS IT BECAUSE THIS IS SUCH A NECESSARY CHANGE TO MAKE RIGHT NOW THAT OFFERS THAT COLLABORATION?

AL: IN MY JUDGMENT IF YOU WANT TO HAVE AN IMPACT ON SOMETHING YOU HAVE TO BE VERY CLOSE TO IT, RATHER THAT DECOUPLE YOURSELVES. IF YOU BUILD WALLS, YOU WILL HAVE SURPRISES FROM YOUR NEIGHBOR FROM THE OTHER SIDE OF THE WALL. IN MY JUDGMENT TODAY I READ THAT BORROSO (JOSE MANUEL BARROSO, PRESIDENT OF THE EUROPEAN COMMISSION) HAS ELABORATED A PLAN FOR THE MODERNIZATION OF RUSSIA IN RESPONSE TO HIS CONVERSATION HE HAD WITH MEDVEDEV. IT IS A STEP IN THE RIGHT DIRECTION. I THINK THE EUROPEAN UNION SHOULD ENGAGE RUSSIA MORE AND MORE ON THESE ISSUES AND I THINK IT WILL INDUCE RUSSIA TO CHANGE MUCH FASTER.

LB: IN THAT REGARD DO YOU HAVE ANY QUESTIONS FOR US? OR OTHERWISE WE HAVE A FEW MORE FOR YOU, IF THAT IS OKAY. I DON'T KNOW HOW MUCH TIME YOU HAVE?

AL: THAT'S OKAY BUT I WOULD LOVE TO HAVE A MORE DETAILED REPORT, IF IT IS AVAILABLE OR WHEN IT IS AVAILABLE. OF COURSE I WOULD BE GLAD TO KEEP IN TOUCH, AND MAYBE FROM TIME TO TIME TO HAVE A MEETING OR SOME KIND OF INFORMATIVE DISCUSSION.

LB: ACTUALLY, BOTH REM KOOLHAAS & REINIER DE GRAAF WHO ARE THE MAIN PARTNERS OF OUR OFFICE WORKING PRIMARILY ON THESE PROJECTS, UNFORTUNATELY COULD NOT BE PRESENT TODAY BECAUSE OF THEIR TRAVEL SCHEDULES. BUT BOTH PARTNERS ARE VERY INTERESTED IN MEETING WITH YOU FACE TO FACE, IF YOU HAVE SOME TIME IN THE COMING MONTHS, PERHAPS WE CAN MAKE AN APPOINTMENT TO CONTINUE THIS DISCUSSION.

AL: I WOULD BE PLEASED TO DISCUSS WITH YOU FURTHER.

LB: I CAN SHARE WITH YOU THE FULL (MCKINSEY) REPORT; AS YOU ONLY RECEIVED A SELECTION OF SLIDES FROM THE COMPREHENSIVE TECHNICAL ANALYSIS. THE FULL REPORT IS OVER 375 PAGES.

(LAUGHING)

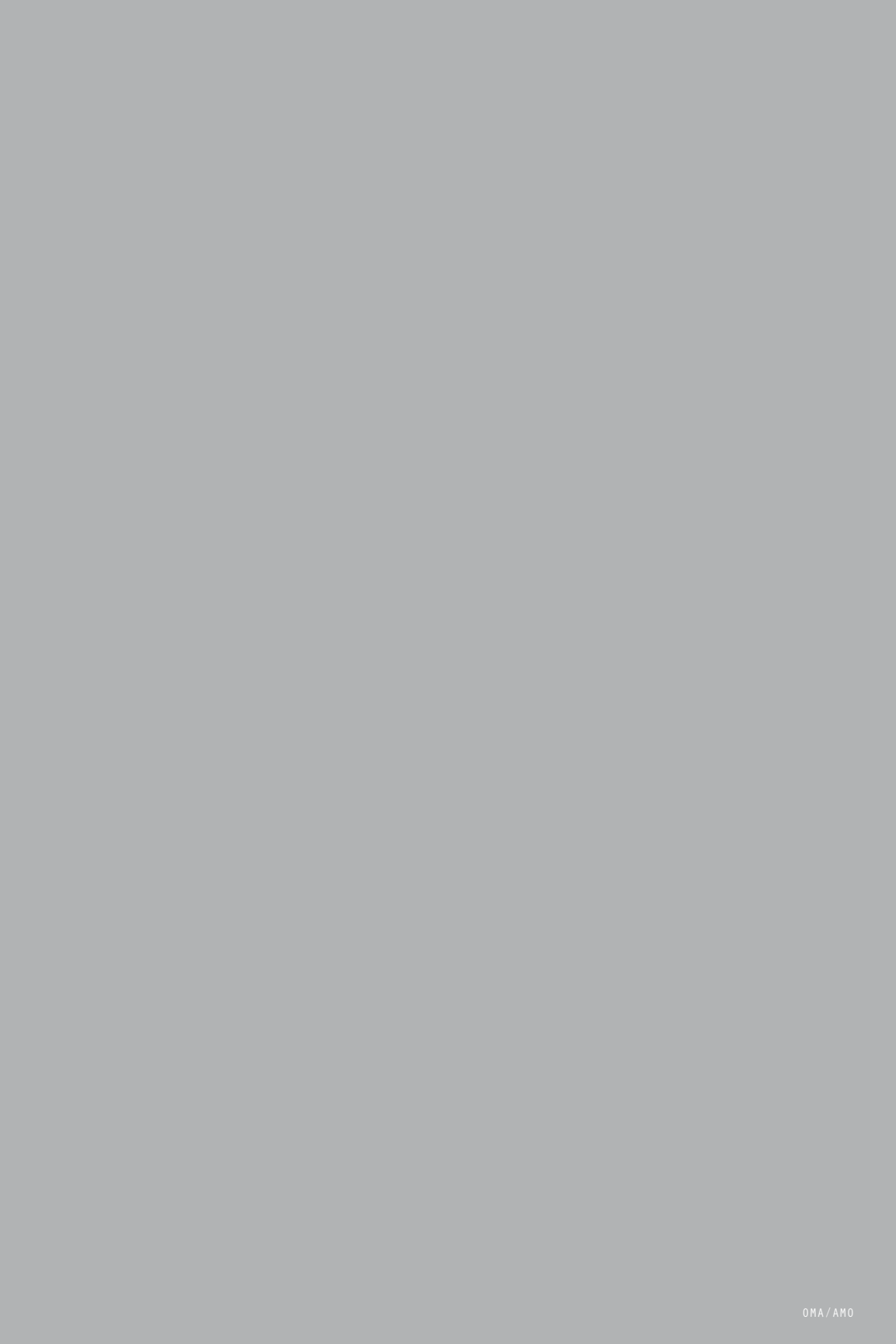
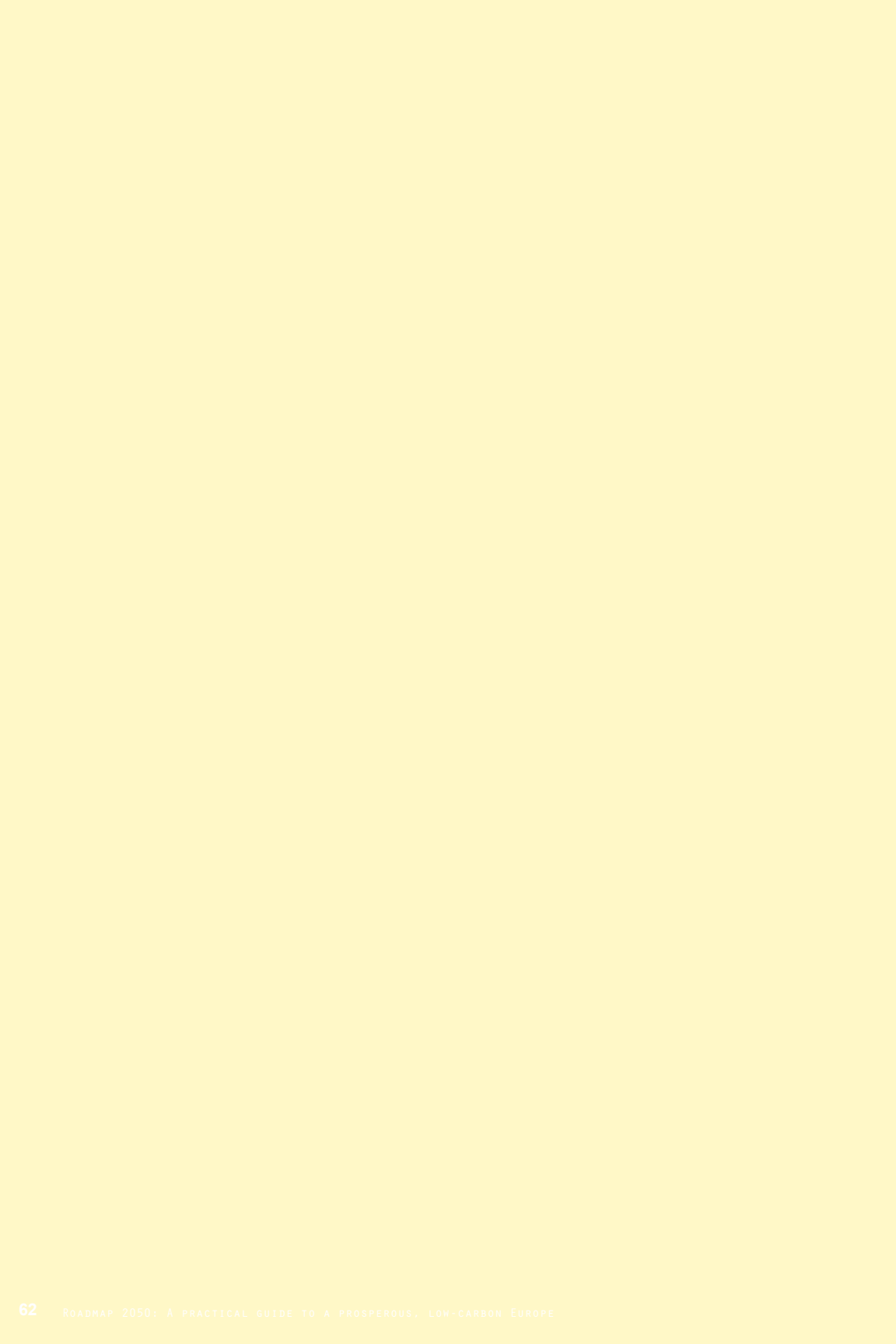
AL: THAT WOULD BE VERY HELPFUL AND I WILL CIRCULATE IT AMONG THE TASK FORCE MEMBERS AND MAYBE THEN WE WILL HAVE SOME ADDITIONAL COMMENTS FOR YOU.

(WRAPPING UP)

LB: OK, THANK YOU VERY MUCH FOR YOUR TIME.

AL: IT WAS A PLEASURE.

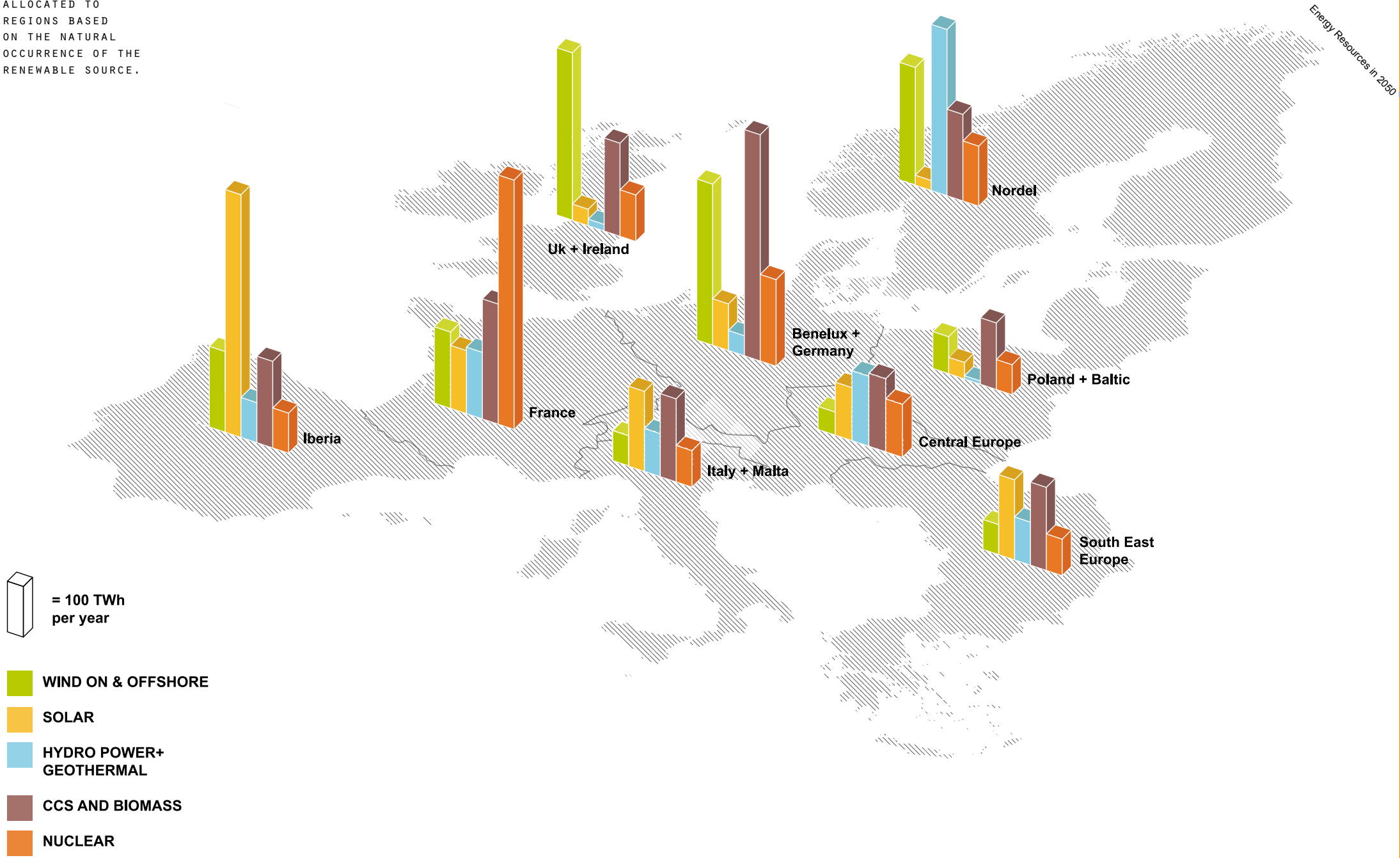
TM: THANK YOU, GOODBYE.



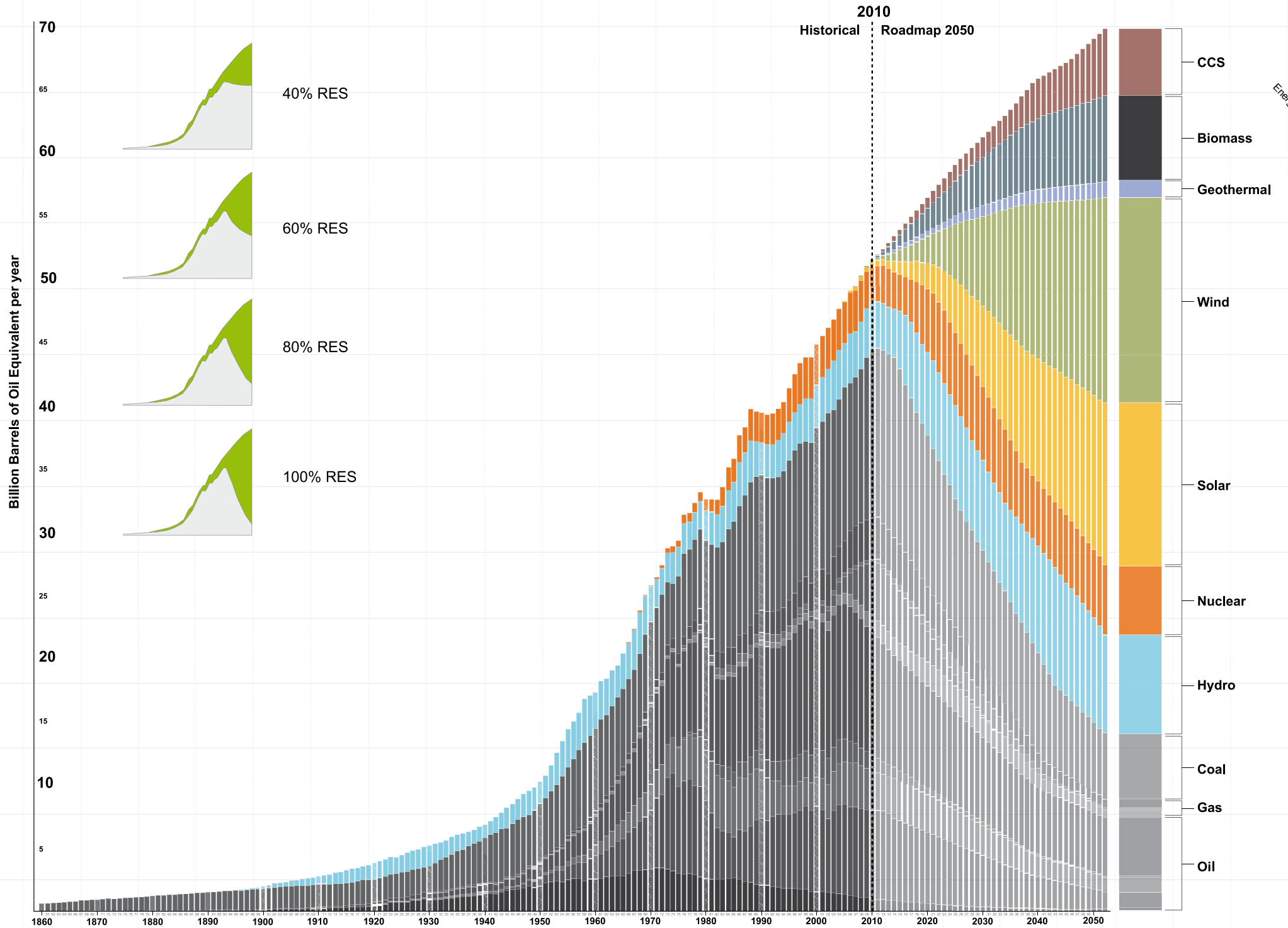


# ENERGY RESOURCES IN 2050 (HIGH RES PATHWAY)

RENEWABLE TECHNOLOGIES ARE ALLOCATED TO REGIONS BASED ON THE NATURAL OCCURRENCE OF THE RENEWABLE SOURCE.



# ENERGY SUPPLY IN 2050 (HIGH RES PATHWAY)

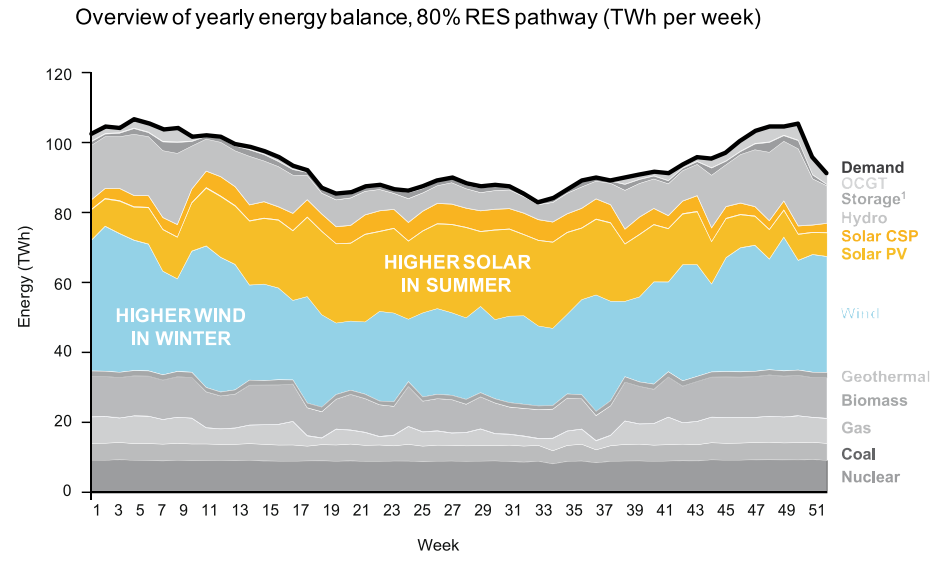
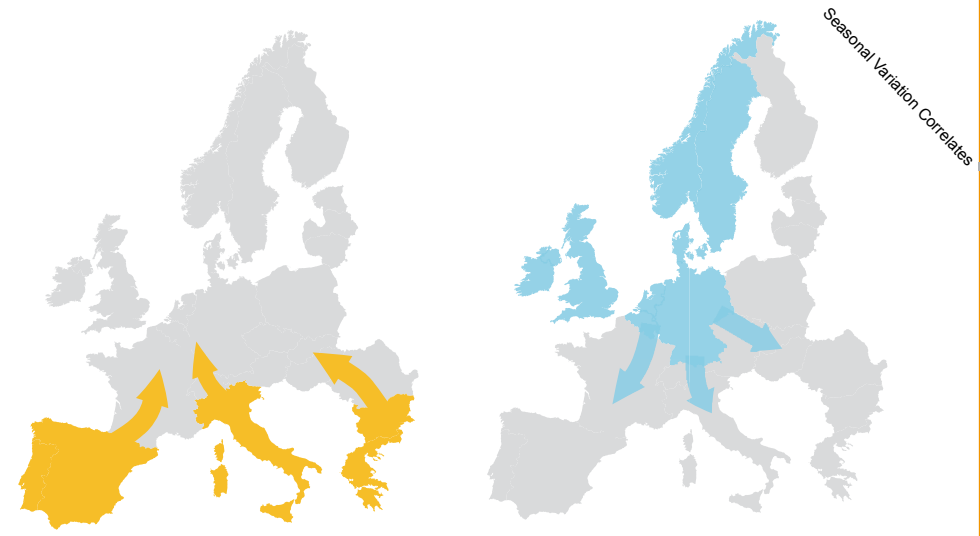
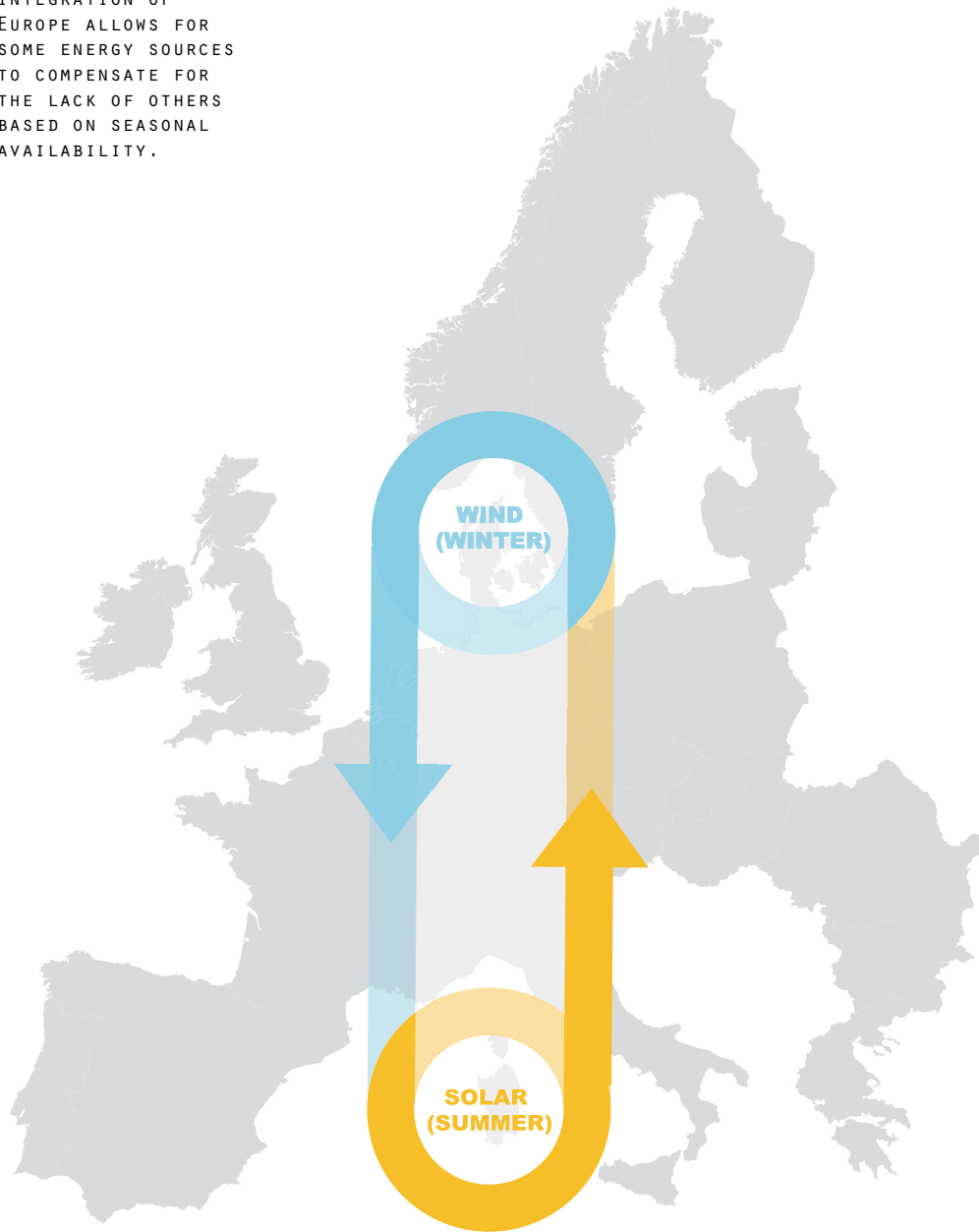


Sources: Roadmap 2050 Technical Analysis, McKinsey / Lynn Orr, Changing the World's Energy Systems, Stanford University Global Climate & Energy Project (after John Edwards, American Association of Petroleum Geologists); SRI Consulting; / David Rutledge, Professor, California Institute of Technology 2009 / The Oil Age: World Oil Production 1859-2050, San Francisco, CA, Courtesy of San Francisco Informatics; / Dr. Colin J. Campbell's oil depletion model: The Coming Oil Crisis, by Colin J. Campbell, Independent Publishers Group, April 1, 2004 / The Twenty First Century, The World's Endowment of Conventional Oil and Its Depletion, By Dr. Colin Campbell, 1996 / International Energy Agency

Energy Supply 2050

# RES DIVERSITY CONTRIBUTES TO CONSISTENT SUPPLY

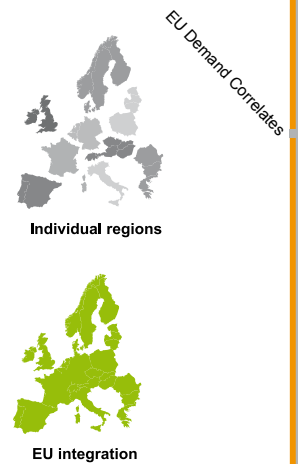
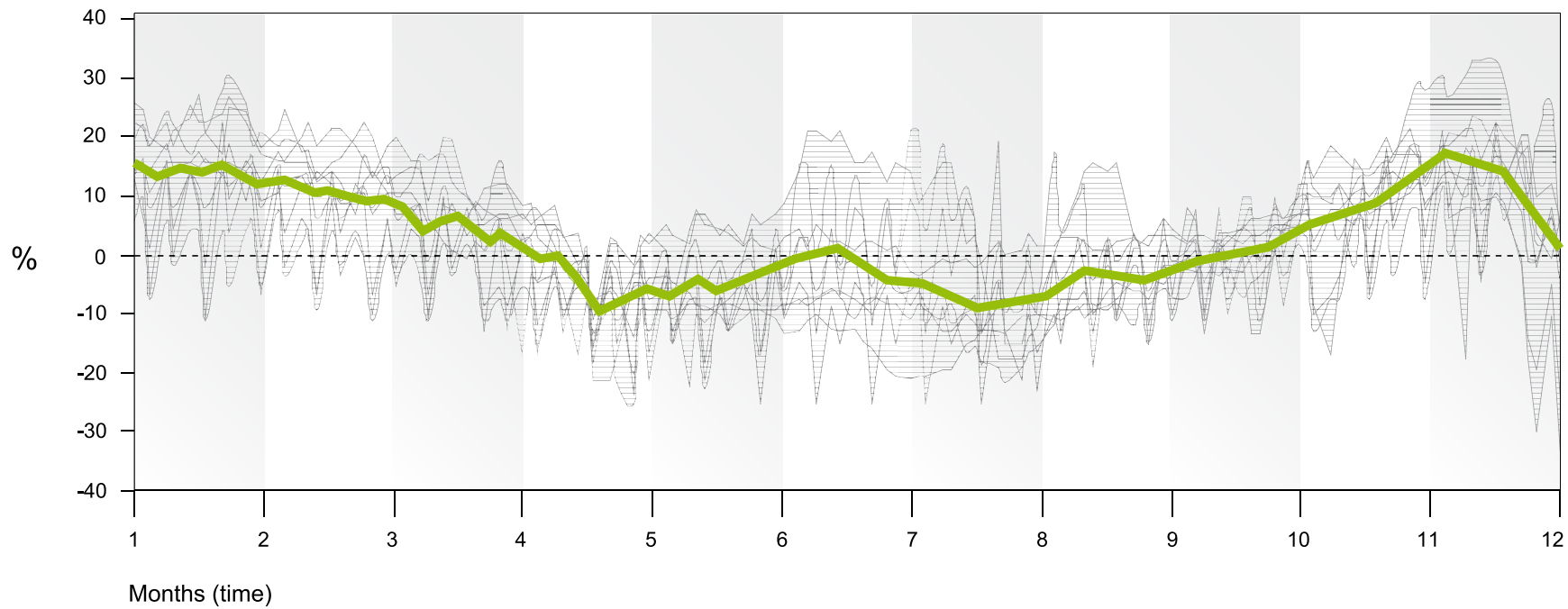
OVER THE COURSE OF THE YEAR, THE INTEGRATION OF EUROPE ALLOWS FOR SOME ENERGY SOURCES TO COMPENSATE FOR THE LACK OF OTHERS BASED ON SEASONAL AVAILABILITY.



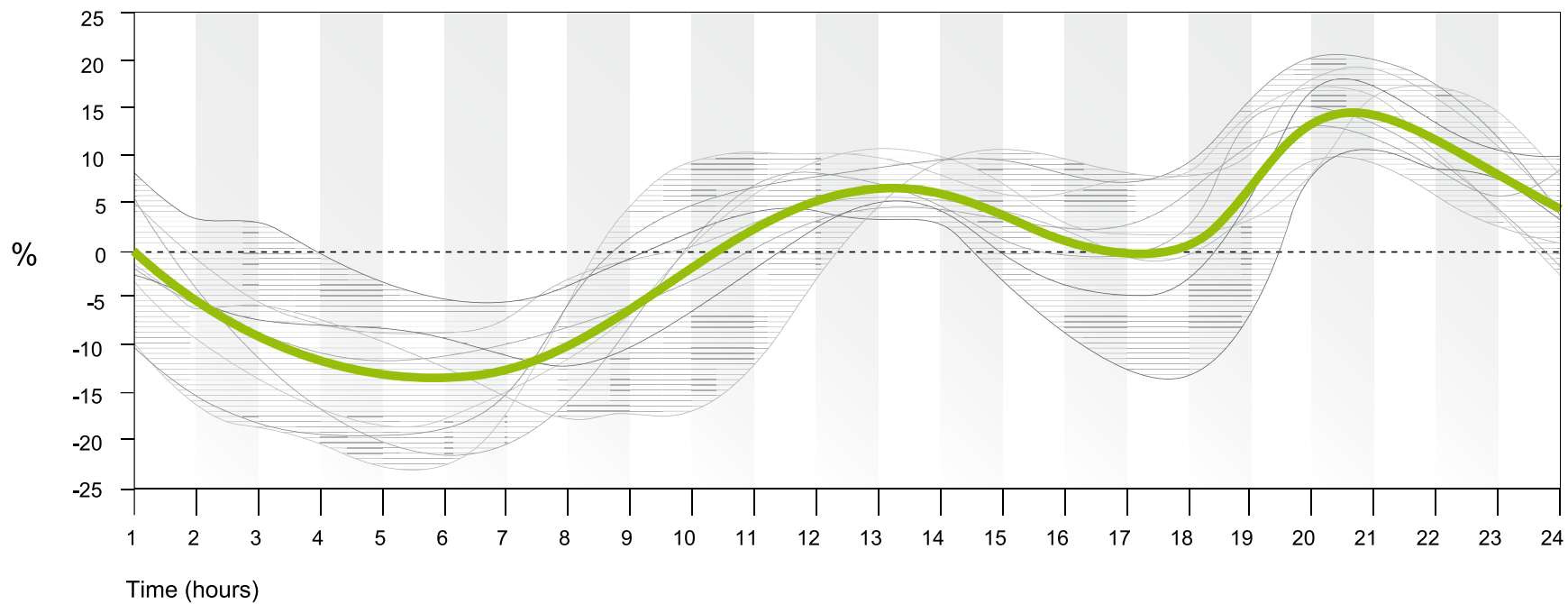
<sup>1</sup> Storage included in the model relates to the existing hydro storage available across the regions  
SOURCE: Imperial College, KEMA, Roadmap 2050 Technical Analysis

# COMBINING REGIONAL DEMAND CURVES REDUCES VOLATILITY

Regional demand variation from average over the year

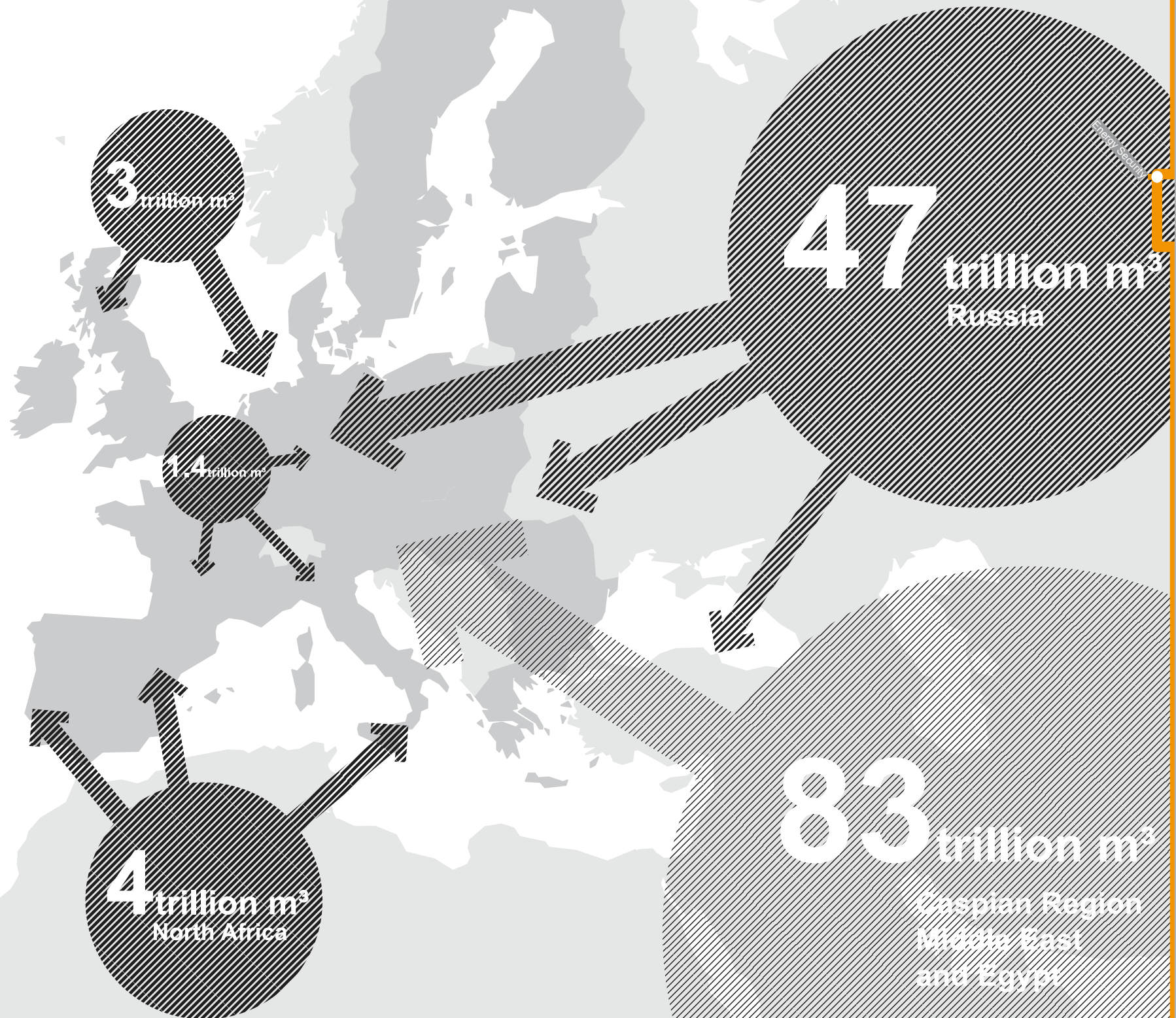


Regional demand variation from average per hour on weekend day



# EUROPEAN ENERGY SECURITY

TODAY EUROPE  
RETAINS A LARGE  
DEPENDENCY ON  
OTHER NATIONS FOR  
NATURAL GAS. A  
PRIMARY INCENTIVE  
FOR EUROPEAN  
INTEGRATION IS THAT  
IT ENHANCES OUR OWN  
ENERGY SECURITY  
AND REDUCES  
OUR DEPENDENCY  
ON OTHERS, AND  
ESPECIALLY ON  
POLITICALLY  
UNSTABLE REGIONS.



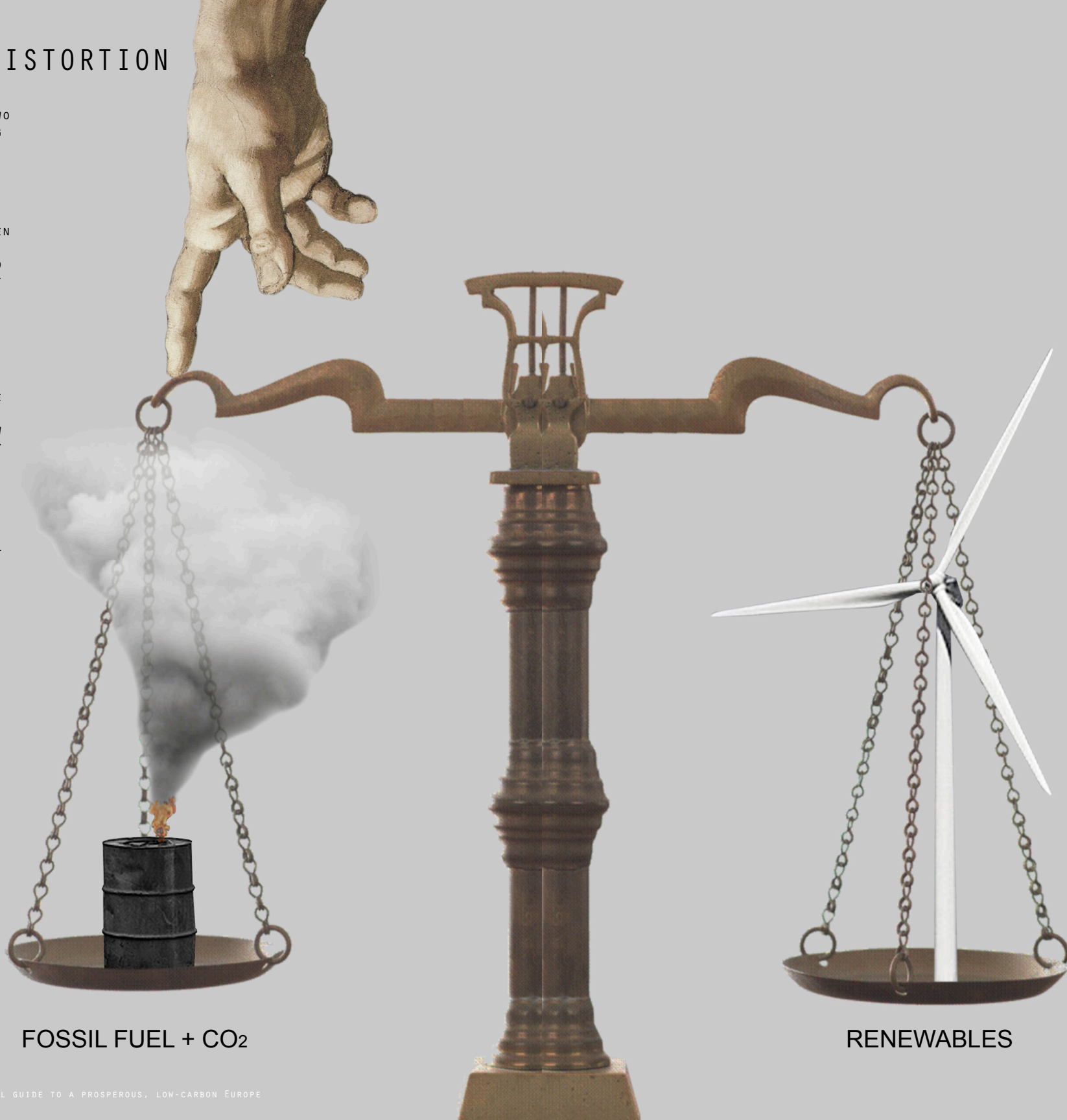
Estimated available Natural Gas deposits measured in Trillion(s) of cubic meters.

SOURCE: BP Statistical Review 6/2006: [http://www.bp.com/liveassets/bp\\_internet/switzerland/corporate\\_switzerland/STAGING/local\\_assets/downloads\\_pdfs/pq/pm\\_statistical\\_review\\_of\\_world\\_energy\\_full\\_report\\_2006.pdf](http://www.bp.com/liveassets/bp_internet/switzerland/corporate_switzerland/STAGING/local_assets/downloads_pdfs/pq/pm_statistical_review_of_world_energy_full_report_2006.pdf)

# MARKET DISTORTION

"THERE ARE ONLY TWO WAYS OF OVERCOMING MARKET DISTORTION: THE FIRST IS THE PRICING OF CARBON AND THE SECOND IS THE CIVIL SOCIETY. THE FIRST WILL THEN FORCE BUSINESSES TO REORIENT AND TO THINK IN DIFFERENT TERMS AND THE SECOND WE NEED TO OUTREACH TO THE CIVIL SOCIETY NOT THROUGH DAY-AFTER-DAIES (DOOMS-DAY) ABOUT CLIMATE CHANGE, BUT ABOUT THE REALITY OF HOW MUCH THEY ACTUALLY PAY TO FUEL A CAR AND THE PRICE OF SUBSIDIES THAT ALTER THE MARKET."

ALEXANDER LIKHOTAL  
TRANSCRIPTS P.52



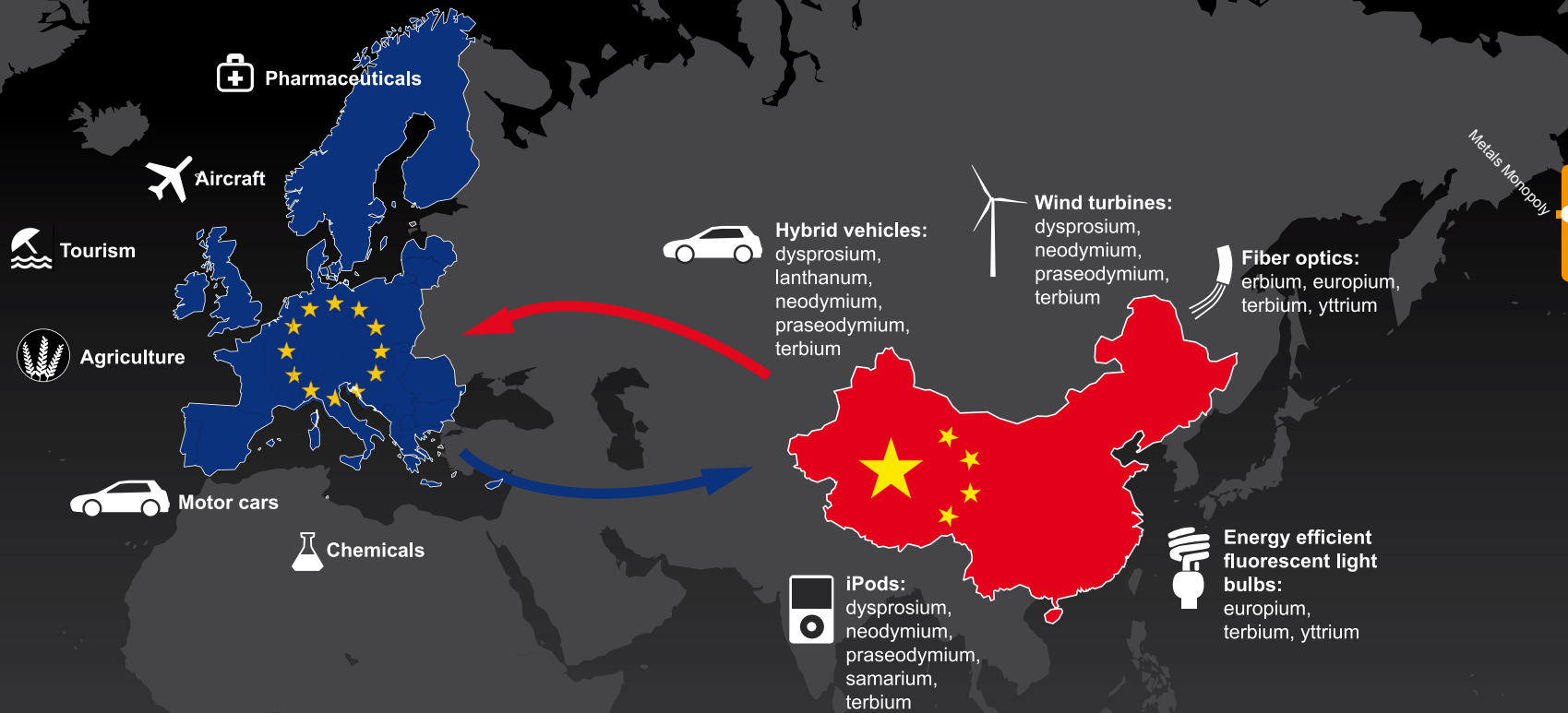
FOSSIL FUEL + CO<sub>2</sub>

RENEWABLES

Market Distortion

# ADVANTAGES OF TRADE

CHINESE SOIL IS THE GROUND FOR MANY OF THE RARE MINERALS WHICH ARE USED TO MAKE MANY OF THE RENEWABLE ENERGY TECHNOLOGIES. AT THE SAME TIME, EUROPE CAN OFFER RESOURCES AND TECHNOLOGY WHICH CHINA LACKS. HEALTHY COMPETITION IN R&D CAN PRODUCE MORE BENEFICIAL TRADE.



## Market cornered for rare minerals

As resource-hungry China scours the world for crude oil and natural gas supplies, it has managed to corner the global market for a group of obscure metals used to make iPods, wind farms and electric cars.

The mainland supplies at least 95 percent of the world's rare earths — 17 chemical elements with names such as praseodymium and yttrium — essential for a wide range of high-tech

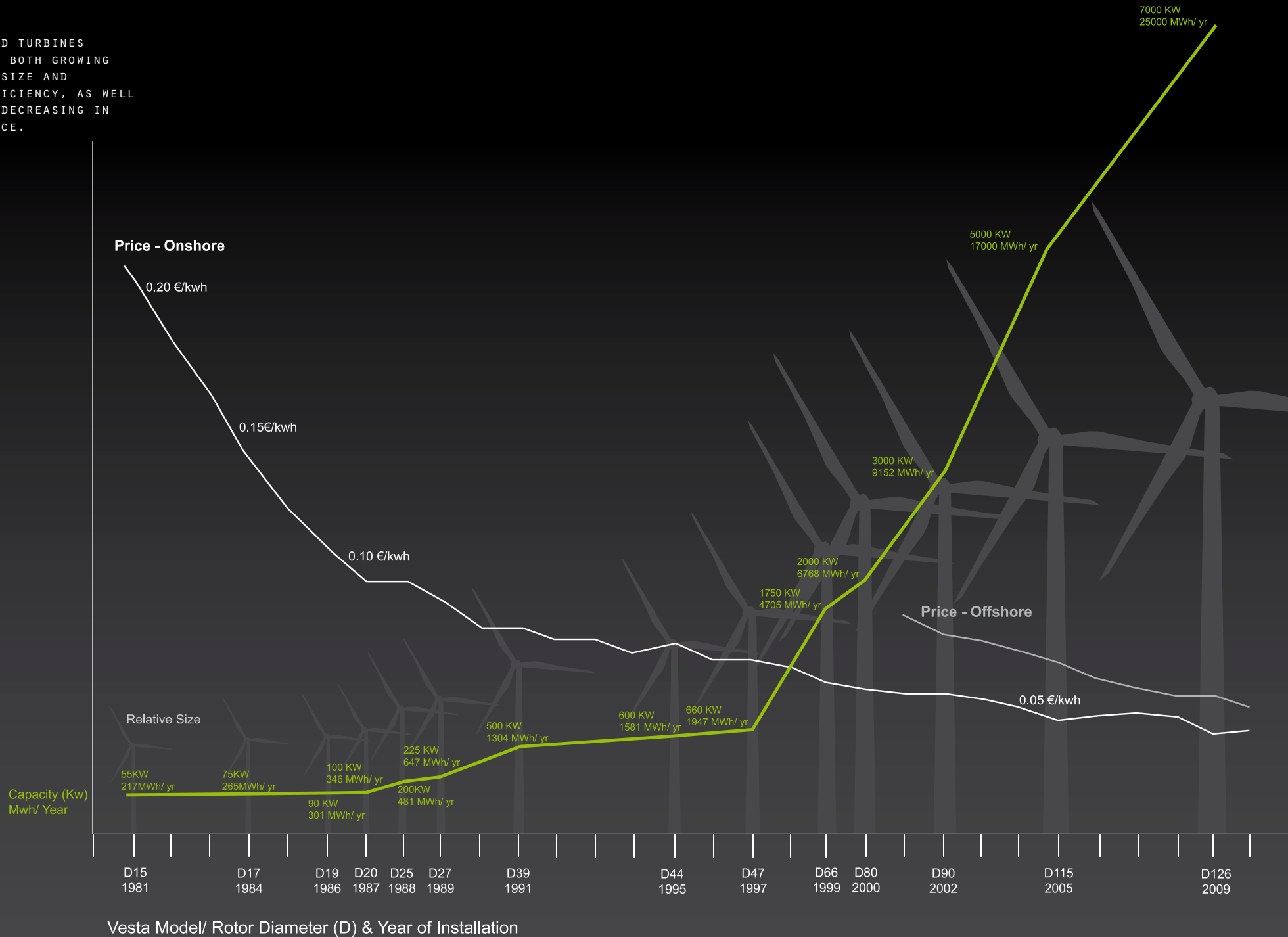
China as well as Russia, India and Brazil. China keeps most of the minerals within its borders by restricting foreign shipments.

Authorities have been increasingly restricting exports in recent years to prop up prices, ensure supply for its own needs and create jobs for millions of migrant workers by luring foreign companies to its shores.

Alarm bells started ringing this year amid reports that the State Council was considering

# GROWTH IN WIND TURBINE EFFICIENCY

WIND TURBINES ARE BOTH GROWING IN SIZE AND EFFICIENCY, AS WELL AS DECREASING IN PRICE.

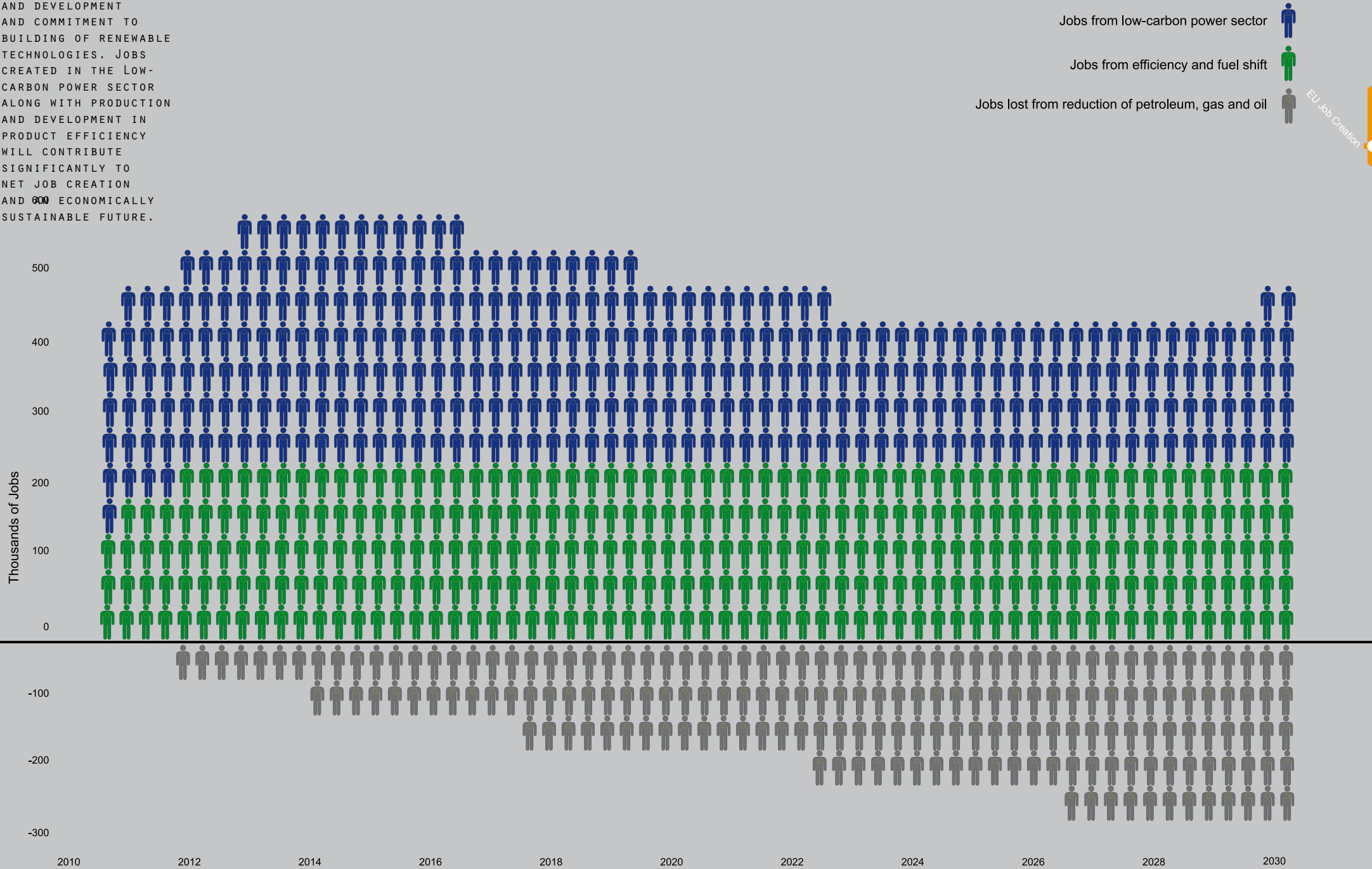


Growth in Wind Turbines



# EU JOB CREATION

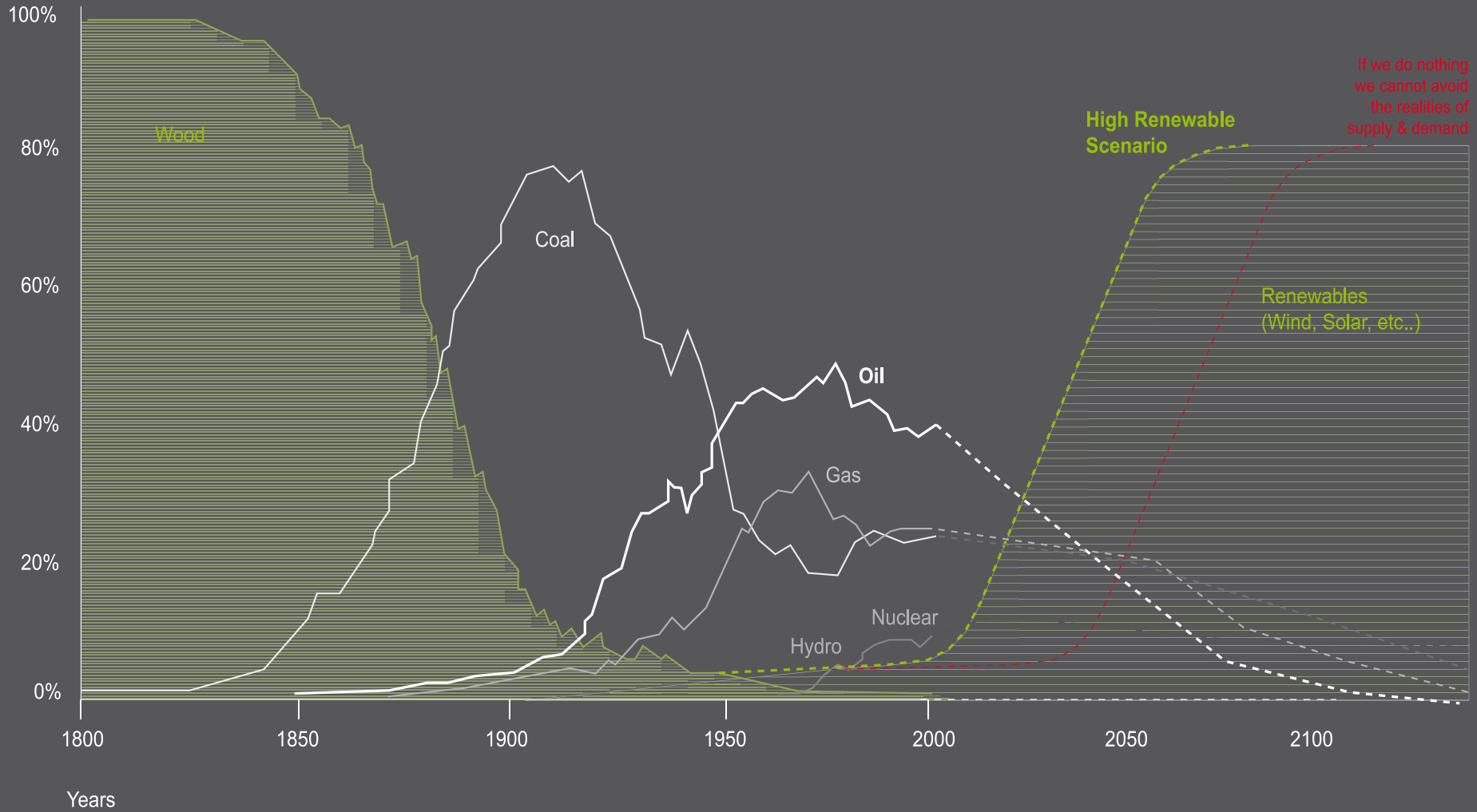
JOBS ARE EXPECTED TO INCREASE WITH INVESTMENT IN RESEARCH AND DEVELOPMENT AND COMMITMENT TO BUILDING OF RENEWABLE TECHNOLOGIES. JOBS CREATED IN THE LOW-CARBON POWER SECTOR ALONG WITH PRODUCTION AND DEVELOPMENT IN PRODUCT EFFICIENCY WILL CONTRIBUTE SIGNIFICANTLY TO NET JOB CREATION AND ~~900~~ ECONOMICALLY SUSTAINABLE FUTURE.



SOURCE: Roadmap 2050 Technical Analysis  
 NOTE: Efficiency and fuel shift investment includes all efficiency levers from McKinsey cost curves (excluding what already in the baseline), further penetration of heatpumps in residential and industry and the slow penetration of EVs

# RENEWABLE ENERGY REPEATS

PRIOR TO THE INDUSTRIAL REVOLUTION, THE WORLD WAS RELIANT ON A RENEWABLE ENERGY SOURCES SUCH AS WOOD. TO CONSTRUCT AND HEAT HOMES. PERHAPS THESE TIMES GIVE EVEN FURTHER EVIDENCE OF HISTORY REPEATING ITSELF, THEREBY ENCOURAGING US TO INVEST IN SUSTAINABLE TECHNOLOGY AND THE PUREST FORM OF RENEWABLE ENERGY SOURCES.



SOURCE: 1366 Technologies  
Selected as one of the world's 50 most innovative companies in renewable energy innovation. [www.1366tech.com/v2/](http://www.1366tech.com/v2/)

INTERVIEW\_

JOHN PERKINS\_

ROTTERDAM\_USA

11 FEBRUARY 2010

JOHN PERKINS

JOHN PERKINS WAS RECRUITED BY THE NATIONAL SECURITY AGENCY DURING HIS LAST YEAR AT BOSTON UNIVERSITY'S SCHOOL OF BUSINESS ADMINISTRATION, 1968. HE SPENT THE NEXT THREE YEARS IN THE PEACE CORPS IN SOUTH AMERICA AND THEN IN 1971 JOINED THE INTERNATIONAL CONSULTING FIRM OF CHAS. T. MAIN. AS CHIEF ECONOMIST AND DIRECTOR OF ECONOMICS AND REGIONAL PLANNING AT CHAS. T. MAIN, PERKINS SAYS HIS PRIMARY JOB WAS TO CONVINCE LESS DEVELOPED COUNTRIES AROUND THE WORLD TO ACCEPT MULTIBILLION DOLLAR LOANS FOR INFRASTRUCTURE PROJECTS AND TO SEE TO IT THAT MOST OF THIS MONEY ENDED UP AT U.S. ENGINEERING/CONSTRUCTION COMPANIES. THE LOANS LEFT THE RECIPIENT COUNTRIES WALLOWING IN DEBT AND HIGHLY VULNERABLE TO OUTSIDE POLITICAL AND COMMERCIAL INTERESTS. HE DOCUMENTS HIS EXPERIENCE IN THE NEW YORK TIMES BESTSELLER CONFESSIONS OF AN ECONOMIC HIT MAN. IN 1981 PERKINS FOUNDED AND BECAME CEO OF INDEPENDENT POWER SYSTEMS, PIONEERING TECHNOLOGIES THAT PROMOTED THE USE OF "WASTE" POWER PLANT HEAT IN HYDROPONIC GREENHOUSES AND OTHER COGENERATION APPLICATIONS. IN 1990, HE SOLD IPS AND FOUNDED A NONPROFIT ORGANIZATION, DREAM CHANGE COALITION, WHICH WORKS CLOSELY WITH AMAZONIAN AND OTHER INDIGENOUS PEOPLE TO HELP PRESERVE THEIR ENVIRONMENTS.

LAURA BAIRD  
OFFICE FOR METROPOLITAN ARCHITECTURE

TANNER MERKELEY  
OFFICE FOR METROPOLITAN ARCHITECTURE

LB: GOOD AFTERNOON, THANK YOU FOR MEETING WITH US.

TM: WE HAVE READ TWO OF YOUR BOOKS AND THOUGHT YOUR EXPERIENCE IN ECONOMICS AND SUSTAINABLE DEVELOPMENT WERE QUIET RELEVANT TO A PROJECT WE ARE WORKING ON AT THEM MOMENT.

(LB & TM GIVE A BRIEF INTRODUCTION OF THE PROJECT)

TM: SO ONE OF THE FIRST QUESTIONS WE HAD FOR YOU IS IN RELATION TO DECISION MAKERS. WE FOUND YOUR EXPERIENCE WORKING AS AN ECONOMIST QUITE INTERESTING. I WAS FASCINATED BY YOUR DESCRIPTION OF THE TIGHT NETWORK AND REVOLVING DOOR PHENOMENON IN GOVERNMENT, INDUSTRY AND MILITARY ADMINISTRATIONS. WITH YOUR EXPERIENCE COULD YOU HIGHLIGHT SOME OF THE POTENTIAL OBSTACLES WE MIGHT BE UP AGAINST BY SUPPORTING A LOW CARBON POWER SECTOR FOR THE EU? AND HOW WE MIGHT BE ABLE TO ADDRESS THESE ISSUES IN OUR POLICY RECOMMENDATIONS?

JP: YOUR BIGGEST OBSTACLES ARE GOING TO BE THE VESTED INTERESTS GROUPS AND CORPORATIONS WHO ARE CURRENTLY INVOLVED IN PRODUCING NON-RENEWABLE ENERGY. FOR INSTANCE THE BIG COAL INDUSTRIES IN GERMANY COULD BE ONE SUCH GROUP. THE KEY WILL BE TO GET THESE VESTED CORPORATIONS ON YOUR SIDE.

LB: CAN YOU BE MORE SPECIFIC? HOW HAVE YOU HAD SUCCESS WITH THAT?

JP: CREATING SITUATION WERE THEY CAN WIN TOO. SO GE (GENERAL ELECTRIC) PRODUCES WIND TURBINES, AND THEY ALSO PRODUCE A LOT OF THINGS THAT GO A LONG WITH CO2 PRODUCING POWER PLANTS. GO TO THEM AND OTHER BIG CORPORATIONS THAT HAVE A STRONG VESTED INTEREST IN CO2 PRODUCING TECHNOLOGIES. MEET WITH THEM AND INVITE THEM TO BECOME YOUR PARTNERS IN THIS. SHOW THEM HOW YOU SEE THE COLLABORATION AS A HUGE OPPORTUNITY TO REALLY GET INTO THIS NEW BUSINESS IN BIG TIME.

CO2 PRODUCING TECHNOLOGY IS A DYING INDUSTRY. CORPORATIONS DO NOT WANT TO MIMIC THE FATE OF THE TELEGRAM COMPANIES, ALL OF WHICH ARE OUT OF BUSINESS TODAY.

REALLY LET THEM KNOW THAT HERE IS AN ENORMOUS PROSPECT AND THAT THIS IS THE WAVE OF THE FUTURE. THERE IS NO QUESTION THAT AT SOME POINT WE ARE GOING TO STOP BUILDING POWER PLANTS THAT CONTINUE PRODUCING CO2. IT IS SIMPLY A MATTER OF WHEN. WHETHER IT IS 2020 OR 2050, THE FACT IS: CO2 PRODUCING TECHNOLOGY IS A DYING INDUSTRY. CORPORATIONS DO NOT WANT TO MIMIC THE FATE OF THE TELEGRAM COMPANIES, FOR EXAMPLE, ALL OF WHICH ARE OUT OF BUSINESS TODAY. OR FOR THAT MATTER THE WAY OF FEDERAL EXPRESS OR THE POST OFFICE WHICH IS NOW BEING RAPIDLY REPLACED BY EMAIL, SKYPE, THE INTERNET, ETC. YOU KNOW THEY WANT TO BE ON TOP OF THE NEW TECHNOLOGIES AND REALLY ENLIST THEM AS PARTNERS IN THIS TO THE FULLEST DEGREE THAT YOU CAN. I ALSO SUGGEST THAT YOU BRING ON LOTS OF GOOD ENTREPRENEURS. FOR INSTANCE: I WAS JUST TEACHING IN CHINA, LECTURING AT A LEADING BUSINESS UNIVERSITY THERE. I WAS SO IMPRESSED BY HOW THE CHINESE MBA STUDENTS ARE SO DEDICATED

TO BECOME THE GREENEST AND ENVIRONMENTALLY CONSCIOUS COUNTRY ON THE PLANET. THESE YOUNG STUDENTS WERE STUDYING ENTREPRENEURSHIP, WHICH CHINA VERY WELL SUPPORTS. IF YOU CAN ALSO BRING SMALL ENTREPRENEURS ONBOARD THAT IS ALSO A PLUS, BUT IN THE LONG RUN, IF YOU CANNOT WIN OVER THE BIG MULTINATIONAL CORPORATIONS YOU ARE NOT GOING TO MAKE IT.

LB: DO YOU HAVE RECOMMENDATIONS FOR INFLUENCING A BIG COMPANY. SURE WE CAN GO AND MEET WITH LARGE COMPANIES ONE AT A TIME AND PRESENT OUR CASE ETC. BUT IS THERE A WAY TO INFLUENCE THE PUBLIC WHO WILL IN RETURN INFLUENCE THE CORPORATIONS? FOR INSTANCE, YOU HAVE WRITTEN ABOUT MAKING DAILY CHOICES AND VOTING WITH YOUR CONSUMER CHOICE, CHOOSING A CERTAIN OIL COMPANY OVER AND OVER WHEN YOU GO TO FILL YOUR CAR UP WITH GAS, BECAUSE THAT COMPANY IS LESS ENVIRONMENTALLY DESTRUCTIVE THAN ANOTHER, ETC. IS THERE A WAY TO UTILIZE THAT KIND OF THINKING TO A LARGER EXTENT TO REALLY PUT CONSUMER PRESSURE ON THESE LARGE CORPORATIONS?

JP: ABSOLUTELY! IF YOU CAN ORGANIZE A GRASSROOTS MOVEMENT WHICH WILL GET PEOPLE TO NOT PURCHASE FROM THESE COMPANIES OR TO GENERATE CONSUMER AWARENESS YOU CAN ALSO HAVE AN IMPACT. TODAY, IT'S EASIER THAN IT HAS EVER BEEN BEFORE BECAUSE OF SOCIAL NETWORKING AND THE INTERNET. IF YOU CAN YOU USE THESE TOOLS EFFECTIVELY, THIS CAN HAVE A VERY DIRECT IMPACT. BEFORE, COMPANIES USED TO SPEND A LOT OF MONEY ON RADIO ADS AND NEWSPAPER ADS TO GET A MESSAGE OUT. BUT TODAY, WITH THE WAY THE INTERNET IS THE WAY IT IS, IT IS SO POWERFUL. YOU CAN JUST TUNE INTO THOSE NETWORKS AND KEEP PUSHING AND GETTING PEOPLE

TODAY YOU CAN  
ACTUALLY CHANGE  
GOVERNMENT  
POLICY WITHOUT  
EVER DEALING  
WITH GOVERNMENT  
AT ALL IF YOU  
CAN BRING THE  
BIG CORPORATIONS  
AROUND: THEY  
ARE THE ONES  
CONTROLLING THE  
GOVERNMENT.

TO INSIST OR DEMAND CHANGE. THE CHANGE WILL HAPPEN. IT IS TERRIBLY IMPORTANT AND YOU HAVE A GREAT OPPORTUNITY TO DO IT IN THIS DAY AND AGE. IT'S JUST THE QUESTION OF WHETHER YOU HAVE THE SKILLS TO DO IT AND THE TIME TO DO IT. I'VE BEEN WORKING ON THIS RECENTLY ESPECIALLY WITH SOCIAL NETWORKING; I HAVE EVEN HIRED A SPECIALIST IN THIS AREA TO HELP ME WHICH WAS VERY EFFECTIVE. SOMETIMES I FEEL LIKE I HAVE ENTERED THE MATRIX. (LAUGHTER)

LB: ONE OF THE QUESTIONS WE HAVE SURROUNDING THE PROJECT IS THAT A LOT OF THE FUNDING ON THE CLIENT'S BEHALF HAS BEEN INVESTED IN TRYING TO INFLUENCE GOVERNMENT. WHILE THAT'S IMPORTANT, CERTAIN KINDS OF VENUES LIKE COPENHAGEN FOR INSTANCE HAVE NOT BEEN A COMPLETE FAILURE, BUT RATHER HAVE NOT BEEN AS SUCCESSFUL AS MANY PEOPLE HAD

HOPED. WE ARE TRYING TO DEVELOP A STRATEGY FOR BOTH GOVERNMENT AND CORPORATE INVOLVEMENT, BECAUSE YOU CANNOT PASS LEGISLATION IF YOU DO NOT APPROACH GOVERNMENT AT ALL. WE FEEL STRONGLY THAT A BOTTOM UP APPROACH REINFORCES THE TOP DOWN APPROACH AND VICE VERSA. FROM YOUR PERSPECTIVE, IS THIS A REASONABLE STRATEGY? WHAT OBSTACLES MIGHT WE COME ACROSS THAT WE SHOULD BE AWARE OF?

JP: WELL TO BE HONEST, TODAY YOU CAN ACTUALLY CHANGE GOVERNMENT POLICY WITHOUT EVER DEALING WITH GOVERNMENT AT ALL IF YOU CAN BRING THE BIG CORPORATIONS AROUND: THEY ARE THE ONES CONTROLLING THE GOVERNMENT. BUT IF YOU ONLY TRY TO CHANGE GOVERNMENT POLICY YOU WILL BE MUCH LESS EFFECTIVE. OBAMA IS AN INCREDIBLE EXAMPLE OF THIS. HERE IS A GUY WHO HAD SO MUCH AMBITION AND EXPECTATION AND HE HAS BASICALLY BEEN PUT IN CHECK BY THE BIG PROFIT ORIENTED CORPORATIONS. THIS STORY IS GOING TO HAPPEN OVER AND OVER. WE ARE VERY MUCH AT A TIME IN HISTORY WHEN THE STATES BECAME NATIONS, EXCEPT NOW THE NATIONS HAVE BECOME ALMOST IRRELEVANT. GOVERNMENTS ARE BECOMING LESS AND LESS INFLUENTIAL. BIG CORPORATIONS ARE CALLING THE SHOTS THESE DAYS. SO IF YOU CAN BRING THE BIG CORPORATIONS AROUND THEY'LL SEE TO IT THAT THE LAWS CHANGE. I LIVE IN FLORIDA AND WE HAVE GOT A GREAT EXAMPLE HERE. THE FLORIDA POWER AND LIGHT COMPANY (FPL) WANTED TO BUILD SOME BIG COAL PLANTS. AT THE TIME, FLORIDA POWER WAS INVOLVED IN LOT OF COMMITTEES AND ALLIANCES AND SO FORTH THAT WERE OPPOSING ANY CARBON RESTRICTIONS, HOWEVER THE PEOPLE OF FLORIDA SPOKE VERY CLEARLY AND SAY 'WE DON'T WANT COAL PLANTS'. NO COMMUNITY WOULD ALLOW THEM TO PERMIT COAL PLANT, SO INSTEAD NOW THEY BECAME THE LARGEST DEVELOPER IN WIND AND SOLAR IN THE UNITED STATES. NOW THEY ARE ON ALL THE COMMITTEES THAT ARE DEFENDING TO HAVE CARBON DIOXIDE CONTROLS IN PLACE. NOW, THEIR NEIGHBOR UTILITY COMPANY IN GEORGIA IS STEALING CLIENTS FROM THE NORTHERN FLORIDA BORDER. GEORGIA HAS A LOT OF COAL AND CAN ESSENTIALLY PRODUCE CHEAPER ENERGY. NOW FLORIDA POWER IS SAYING: 'THEY SHOULDN'T GET AWAY WITH THAT CHEAP CO2 PRODUCING ENERGY. THEY SHOULD HAVE TO PAY TAX ON THEIR CARBON. WE ARE NOT PRODUCING ANY CARBON DIOXIDE HERE IN FLORIDA AND THEY ARE'. SUDDENLY, THIS HUGE COMPANY CAME AROUND FROM BEING OPPOSED TO CARBON STANDARDS THAT WOULD SET LIMITS, TO A COMPANY THAT IS ACTIVELY TRYING TO GET STANDARDS IMPLEMENTED! THAT IS WHAT YOU WANT TO DO. TRY TO GET THOSE COMPANIES TO TURN AROUND LAWS. WHEN THE PUBLIC IS BEHIND IT AND THE CORPORATIONS ARE ALSO BEHIND IT, THEN THE POLITICIANS WILL TAKE CARE OF THE LEGISLATION.

LB: THIS PROPOSAL SPECIFICALLY IS ON A REGIONAL LEVEL WHICH FOCUSES ON A EUROPEAN CONTEXT. WE HAVE FOUND THAT CERTAIN COUNTRIES OR 'EUROPEAN REGIONS' SHARE GEOPOLITICAL SIMILARITIES. FOR INSTANCE SOUTHERN EUROPE HAS MUCH BETTER

SOLAR POTENTIALS THAN NORTHERN EUROPE. BY DIVIDING EUROPE INTO REGIONS IT IS EASIER TO RALLY POLITICAL SUPPORT THAN APPROACHING THE PROBLEM FROM THE EUROPEAN SCALE AS A WHOLE. THE NUMBER OF ORGANIZATIONS AND CORPORATIONS WHICH MUST BUY-IN IS OFTEN DAUNTING. DO YOU HAVE ANY RECOMMENDATIONS OF HOW TO DO THAT? IS IT JUST A MATTER OF SEEKING OUT CERTAIN ORGANIZATIONS WITH THE MOST INFLUENCE?

JP: I AM NOT SURE IN EUROPE WHO YOU NEED TO GO TO. BUT YOU PROBABLY DO KNOW. BUT IF YOU JUST GET ONE CORPORATION, A BIG ONE, BEHIND THIS IT WILL MAKE YOUR LIFE A LOT EASIER. ONE OF THE REASONS I PICK ON NIKE A LOT IN STATES IS BECAUSE I REALIZE THAT IF I CAN GET

IF YOU JUST GET  
ONE CORPORATION,  
A BIG ONE,  
BEHIND THIS  
IT WILL MAKE  
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EASIER.

NIKE TO STOP USING SLAVE LABOR IN SWEATSHOPS IN THE INDONESIA, THEN REEBOK AND EVERYBODY ELSE WILL FOLLOW. IF I GET ADIDAS OR REEBOK TO STOP USING SLAVE LABOR THAT DOESN'T MEAN NIKE WILL FOLLOW. IF NIKE STOPS THEN EVERYBODY ELSE WILL STOP. BESIDES, NIKE WILL SEE TO IT THAT THE APPROPRIATE LAWS ARE PASSED. THEY WILL NOT ALLOW ANYBODY ELSE TO HAVE A MORE COMPETITIVE LABOR ADVANTAGE. GO FOR THE BIGGEST AND THE MOST POWERFUL, WORK OUT A SITUATION THAT SHOWS THAT IT IS IN THEIR BEST INTEREST, GET ON THEIR SIDE AND THEY WILL BRING EVERYBODY ELSE ALONG. IN THE END YOU WILL NOT EVEN NEED TO SPEAK TO ORGANIZATIONS AND GOVERNMENTS. IF YOU CAN GET THOSE BIG COMPANIES TO COME AROUND, THEY WILL TALK TO THE GOVERNMENT. TO ANSWER ONE OF YOUR FIRST QUESTIONS: THEY ARE THE SAME PEOPLE. THE REVOLVING DOOR POLICY, THEY MOVE FROM GOVERNMENT TO BIG CORPORATIONS, THEY MOVE FROM CORPORATIONS TO BECOME HEAD OF VARIOUS CABINETS, OR MINISTRIES IN THE GOVERNMENT. SO FOCUS ON CONVINCING THESE PEOPLE.

LB: AND WHAT DO YOU THINK ABOUT ORGANIZATIONS LIKE GREENPEACE OR THE WORLD WILDLIFE FUND OR THOSE TYPES OF ORGANIZATIONS? SOMETIMES THEY HAVE A HUGE GRASSROOTS SUPPORT NETWORK. THEY FOCUS ON A COLLABORATIVE PUBLIC RATHER THAN GOING FOR THE BIG GUYS AS YOU WERE TALKING ABOUT.

JP: I THINK THAT IS ALSO VERY IMPORTANT. THEY HAVE A LOT OF FOLLOWERS BUT YOU HAVE TO BE VERY CAREFUL. PERHAPS YOU MAY WANT TO HAVE TWO BRANCHES WORKING ON THIS. SO WHAT ARE YOU, ARE YOU NON-PROFIT ORGANIZATION?

LB: WE'RE AN ARCHITECTURE OFFICE ACTUALLY.

JP: YES. YOU MIGHT WANT TO CREATE YOUR OWN NON-PROFIT ORGANIZATION THAT WORKS WITH NON-PROFITS AND IS NOT ASSOCIATED TO YOUR FOR PROFIT COMPANY.

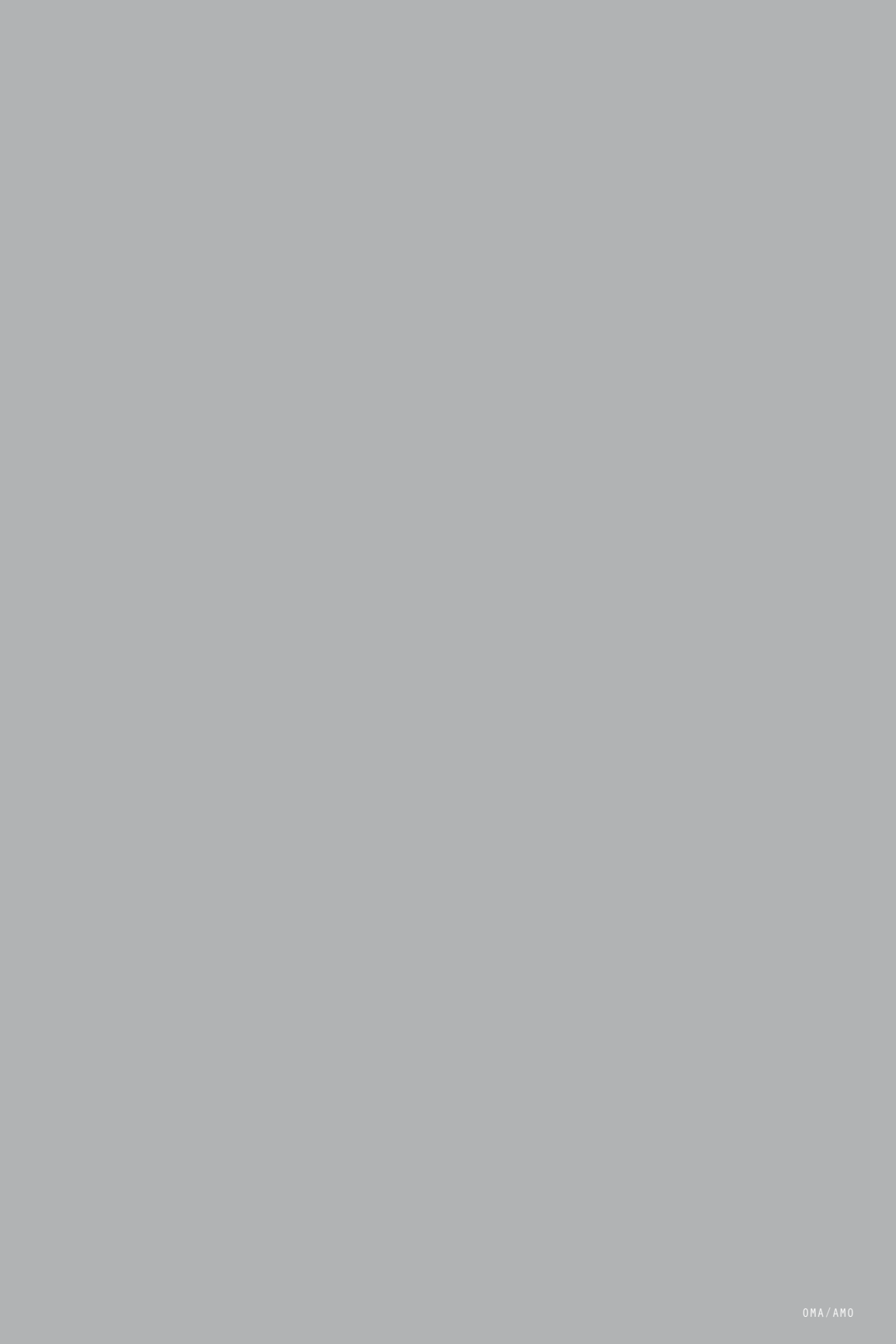
LB: OUR CLIENT ON THIS SPECIFIC PROJECT IS A NON-PROFIT AND WE ARE COLLABORATING WITH SEVERAL NGOS AND OTHER NON-PROFIT ORGANIZATIONS. IT'S ALSO POSSIBLE THAT WE FILTER COMMUNICATION THROUGH OTHER PARTNERS SO WE COULD APPROACH THE CORPORATE WORLD SO TO SPEAK.

JP: THAT'S GOOD, BECAUSE WHAT IT IS ALL ABOUT HERE; OUT ECONOMIC-HITMANNING THE ECONOMIC-HITMAN. (LAUGHTER) ONE OF THE REASONS THE US DEMOCRATS HAVE SUCH A HARD TIME IN POLITICS, IS BECAUSE THEY ARE SO RATIONAL AND THE GAME THAT THEY NEED TO LEARN TO PLAY IS TO DEAL WITH FAMILY VALUES. YOU KNOW THE DEAL WITH IRRATIONAL VALUES RATHER THAN TRYING TO CONVINCING THE PUBLIC TO DO THE RATIONAL THING, BECAUSE PUBLIC DOESN'T UNDERSTAND, DOESN'T TRY TO BE RATIONAL. WHAT YOU NEED TO DO IS TO GET ALL THE BIG NGOS ON YOUR SIDE LIKE GREENPEACE, CONSERVATION INTERNATIONAL IS IMPORTANT THERE. BUT YOU ALSO NEED TO MAKE SURE THAT WITHIN THE PROCESS YOU DON'T ALIENATE YOURSELF FROM THE BIG CORPORATIONS WHO MAY BE IRRITATED AT GREENPEACE FOR OTHER REASONS. SO YOU KNOW SPLIT IT UP AND TRY NOT TO ASSOCIATE TOO MUCH WITH CONTROVERSIAL ORGANIZATIONS.

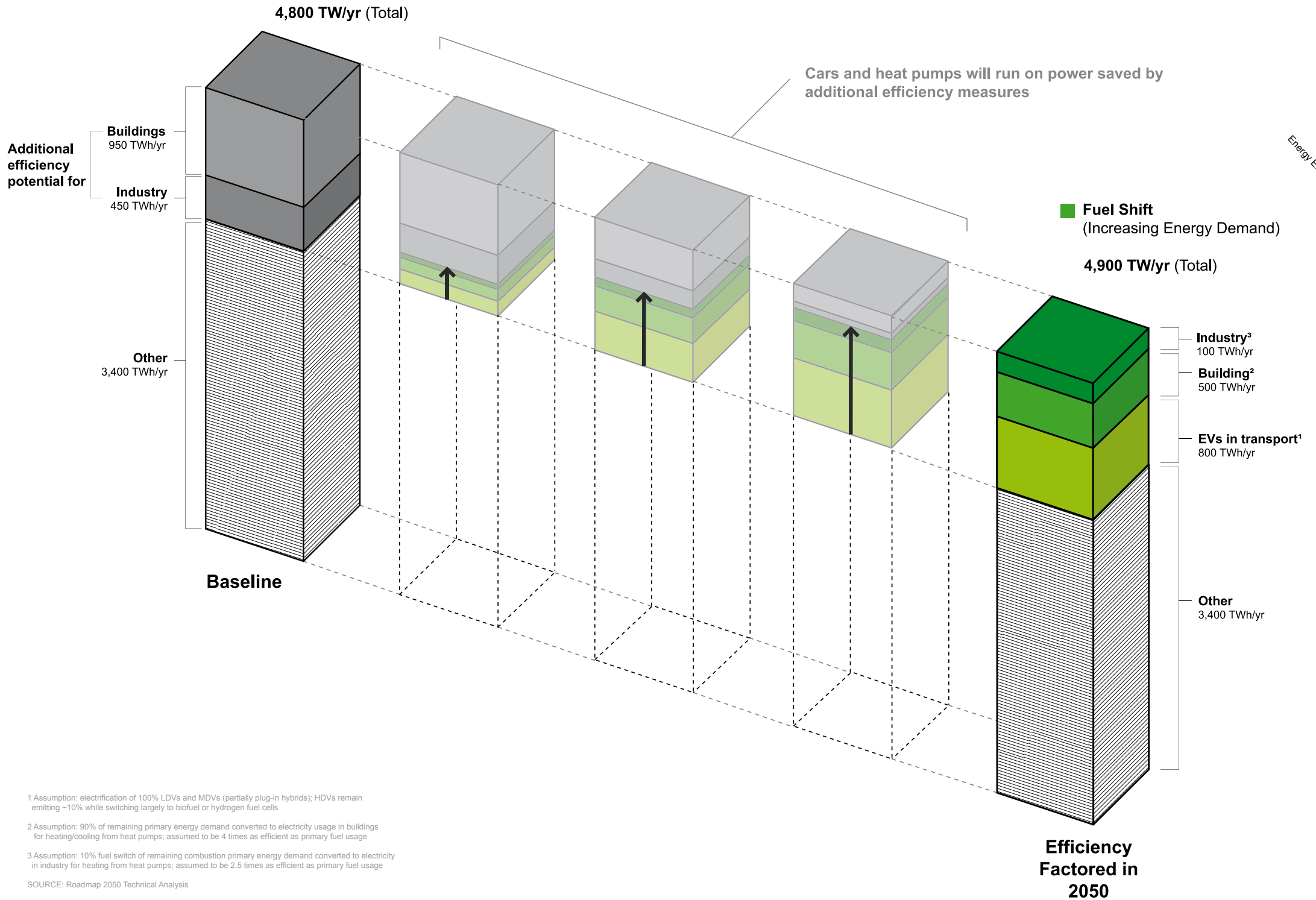
LB: I HAVE A KIND OF MORE GENERAL QUESTION FOR YOU. WHAT DO YOU THINK ABOUT THIS WHOLE MOVEMENT TOWARDS SUSTAINABILITY AND INVESTMENT IN RENEWABLE ENERGY? YOU SAID AT SOME POINT THAT WE HAVE

TO STOP EMITTING CO2. THAT WILL HAPPEN; IT IS ONLY A QUESTION OF WHEN. I JUST WONDER FOR IDEALISTIC POINT OF VIEW, WHAT YOU THINK IT IS GOING TO TAKE, WHEN YOU THINK IT IS GOING TO HAPPEN? IS IT THROUGH PROJECTS LIKE OURS AND PEOPLE TRYING TO GET INVOLVED AND PEOPLE TRYING TO MAKE A CHANGE OR IS IT SOMETHING ELSE? ALSO, WILL IT TAKE A REAL CRISIS TO MOTIVATE PEOPLE?

JP: LET'S FACE IT. YOU HAVE GOT TO DO WHAT YOU'RE DOING AND THAT'S TERRIBLY IMPORTANT. WE DO NOT KNOW WHETHER THAT WILL BE ENOUGH OR NOT. IF IT IS NOT ENOUGH THEN IT IS GOING TAKE A MUCH GREATER CATASTROPHE AND THAT IS OFTEN THE CASE. I THINK THE IMPORTANT THING IS TO FIGHT THE BATTLE. GET OUT THERE AND MAKE IT HAPPEN. DO EVERYTHING YOU CAN TO TURN IT AROUND. WE WANT TO AVOID THE CALAMITY THAT IS COMING. BUT HOW ARE WE GOING TO AVOID IT? ARE WE GOING TO FALL ASLEEP BEHIND THE WHEEL AND DRIVE THE TITANIC INTO THE ICE? OR ARE WE GOING TO WAKE UP AND WATCH WHAT WE'RE DOING AND BECOME MORE CONSCIOUS? YOU ARE TRYING TO MAKE US ALL MORE CONSCIOUS AND THAT IS VERY IMPORTANT. I HOPE YOU SUCCEED. IF YOU DO NOT SUCCEED THEN THERE IS GOING BE MORE ICEBERGS MELTING AND FLORIDA IS GOING BE UNDER WATER. WHEN PEOPLE ARE DIRECTLY AFFECTED THEY WILL PROBABLY BEGIN TO CHANGE. BUT LET US HOPE WE CAN AVOID THE EXTREMES AND FOLLOW YOUR EXAMPLE. I WISH YOU LOTS OF SUCCESS.



# ENERGY EFFICIENCY & FUEL SHIFT BALANCE DEMAND



1 Assumption: electrification of 100% LDVs and MDVs (partially plug-in hybrids); HDVs remain emitting ~10% while switching largely to biofuel or hydrogen fuel cells

2 Assumption: 90% of remaining primary energy demand converted to electricity usage in buildings for heating/cooling from heat pumps; assumed to be 4 times as efficient as primary fuel usage

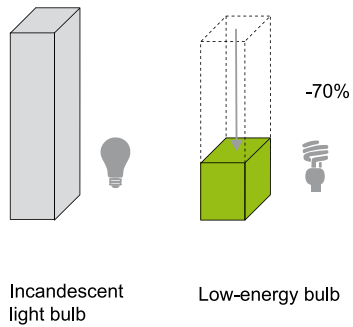
3 Assumption: 10% fuel switch of remaining combustion primary energy demand converted to electricity in industry for heating from heat pumps; assumed to be 2.5 times as efficient as primary fuel usage

SOURCE: Roadmap 2050 Technical Analysis



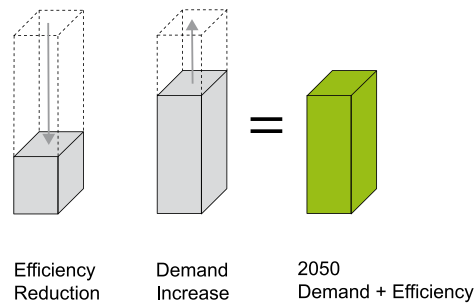
# ADDED EFFICIENCY BENEFITS

## REDUCE ENERGY CONSUMPTION



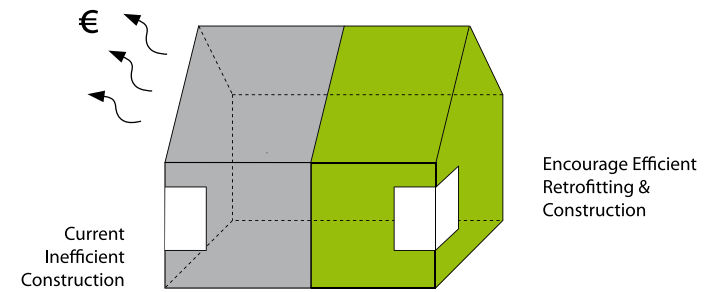
THE OVERALL ABILITY OF THE EU TO DECARBONISE IS DEPENDENT ON ACHIEVING AGGRESSIVE ENERGY EFFICIENCY SAVINGS.

## OFFSET INCREASING ENERGY DEMAND



WITHOUT ENERGY EFFICIENCY SAVINGS, ENERGY DEMAND WILL INCREASE AND IT WILL BE HARDER AND MORE EXPENSIVE TO MEET THAT DEMAND.

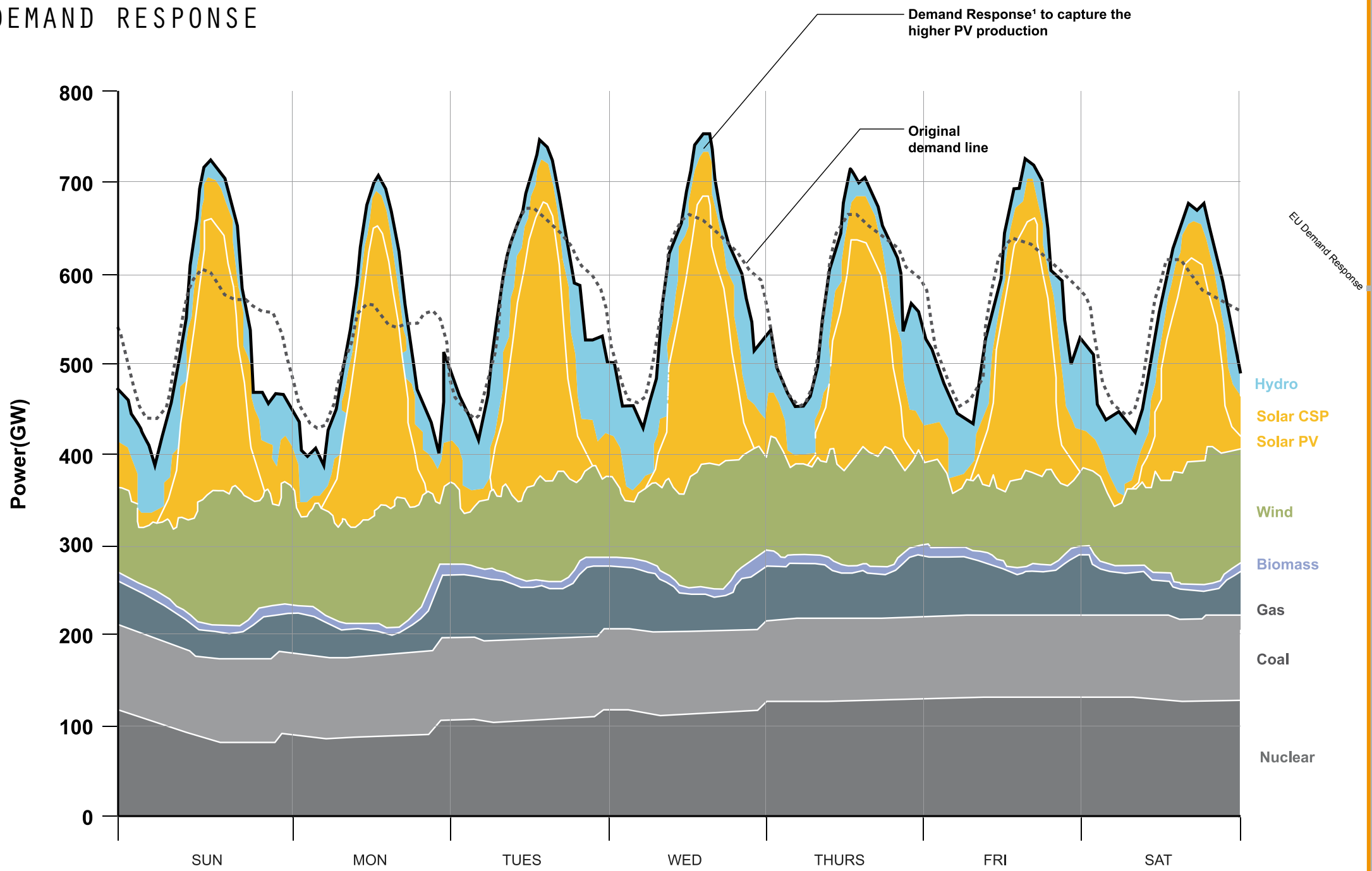
## INCREASE ENERGY EFFICIENCY SAVINGS<sup>3</sup>



ENERGY EFFICIENCY SAVINGS SHOULD BE PURSUED URGENTLY. THEY CAN BE MADE NOW, AND THE MAJORITY ARE CHEAPER THAN BUILDING NEW. THIS IS HAS A SPECIFIC IMPACT ON CO<sub>2</sub> EMISSIONS IF IT IS UNABATED FOSSIL GENERATION THAT IS BEING BUILT TO MEET DEMAND THAT COULD HAVE BEEN MET BY ENERGY SAVINGS.

1) Compact fluorescent lamps (CFLs) use about 70% less electricity to produce the same light as a normal bulb, cutting greenhouse gas by over 50%. SOURCE: [www.bbc.co.uk/bloom](http://www.bbc.co.uk/bloom)  
 2) SOURCE: Roadmap 2050 Technical Analysis  
 3) Buildings are responsible for 40% of energy consumption and 36% of EU CO<sub>2</sub> emissions. Energy performance of buildings is key to achieve the EU Climate & Energy objectives SOURCE: [www.ec.europa.eu/energy/efficiency](http://www.ec.europa.eu/energy/efficiency)

# DEMAND RESPONSE



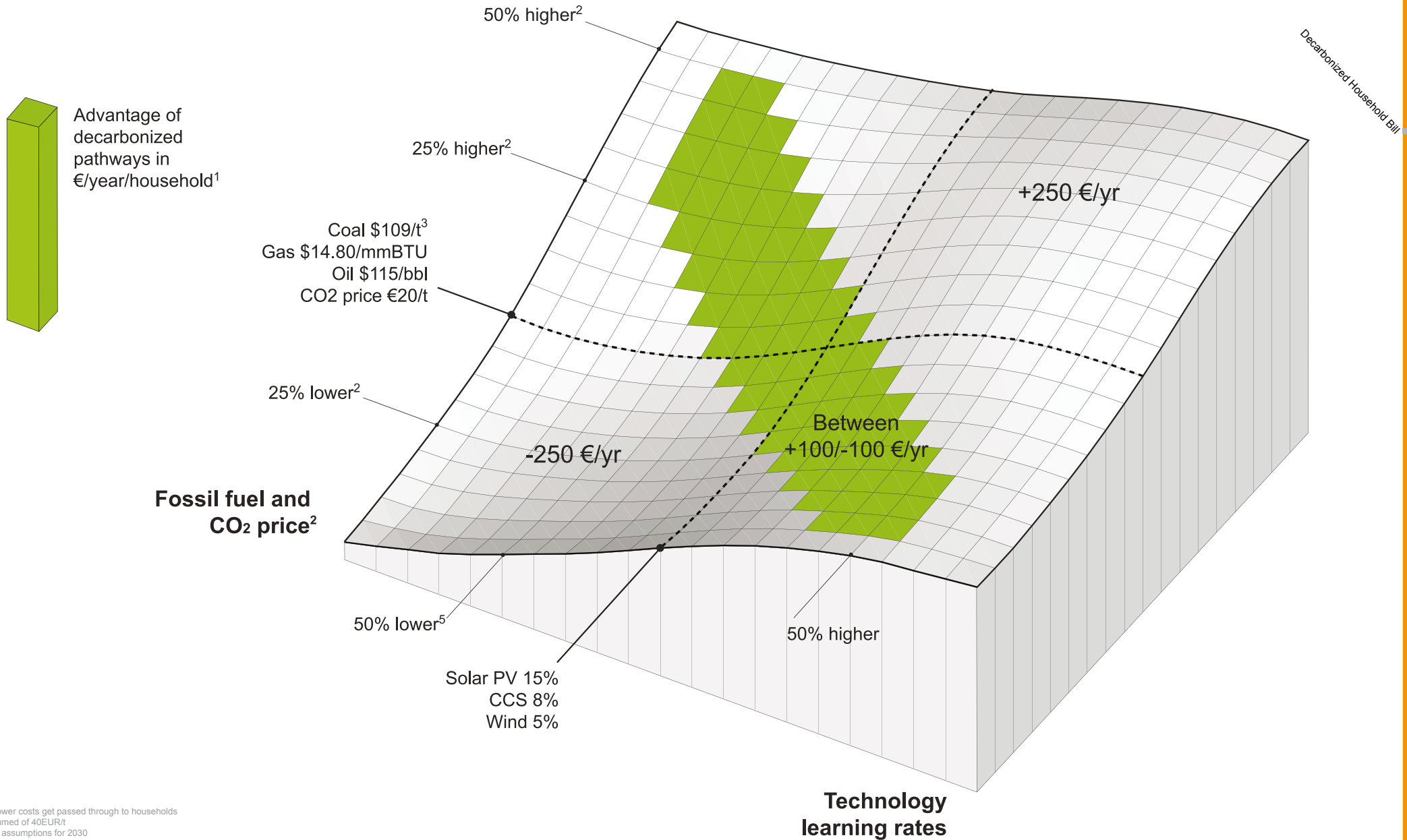
**Daily Power Demand In A Week<sub>2</sub>**

"Demand response as used in this paper refers to changing a customer's electricity demand in response to dispatch instructions or price signals through communications technologies. In the Volume 1 analysis, it is assumed that any such changes retained the total energy consumed within the day, that is, moved or shifted demand rather than reduced total daily consumption"

- 1) The graph shows how the original demand line (dashed) is shifted to a higher level (black line) by DR to capture the higher PV production
- 2) 60% RES, 20% DR, Week 32 - Sunny week

SOURCE: Roadmap 2050 Technical Analysis

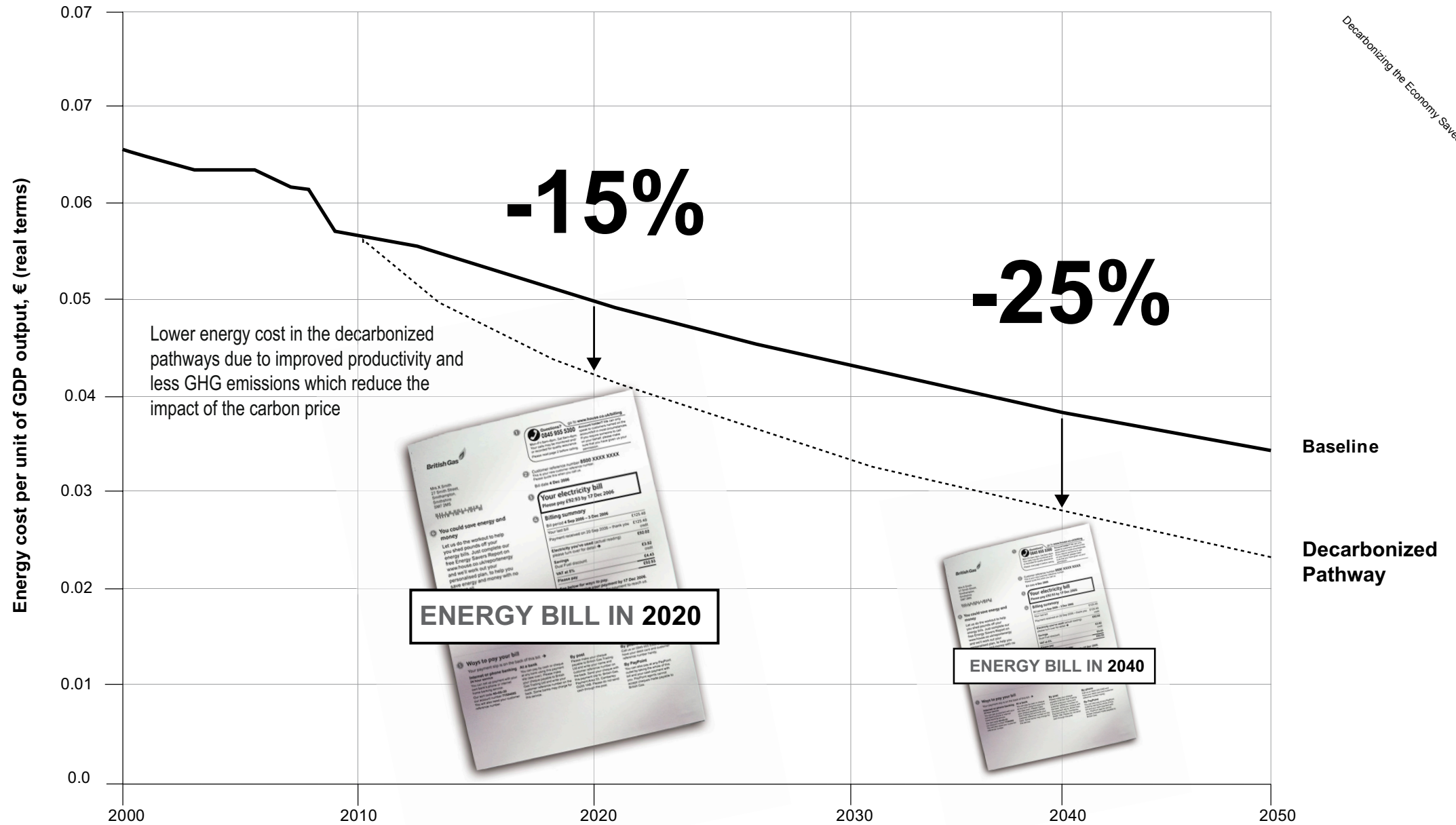
# DECARBONIZED HOUSEHOLD BILL COSTS



1) Assuming all power costs get passed through to households  
2) CO2 Price assumed of 40EUR/t  
3) IEA WEO 2009 assumptions for 2030  
4) No CO2 price  
5) For all technologies. Learning rate is defined as capex improvement per doubling of cumulative installed capacity

SOURCE: Roadmap 2050 Technical Analysis

# DECARBONIZING THE ECONOMY SAVES MONEY



Decarbonizing the Economy Saves Money

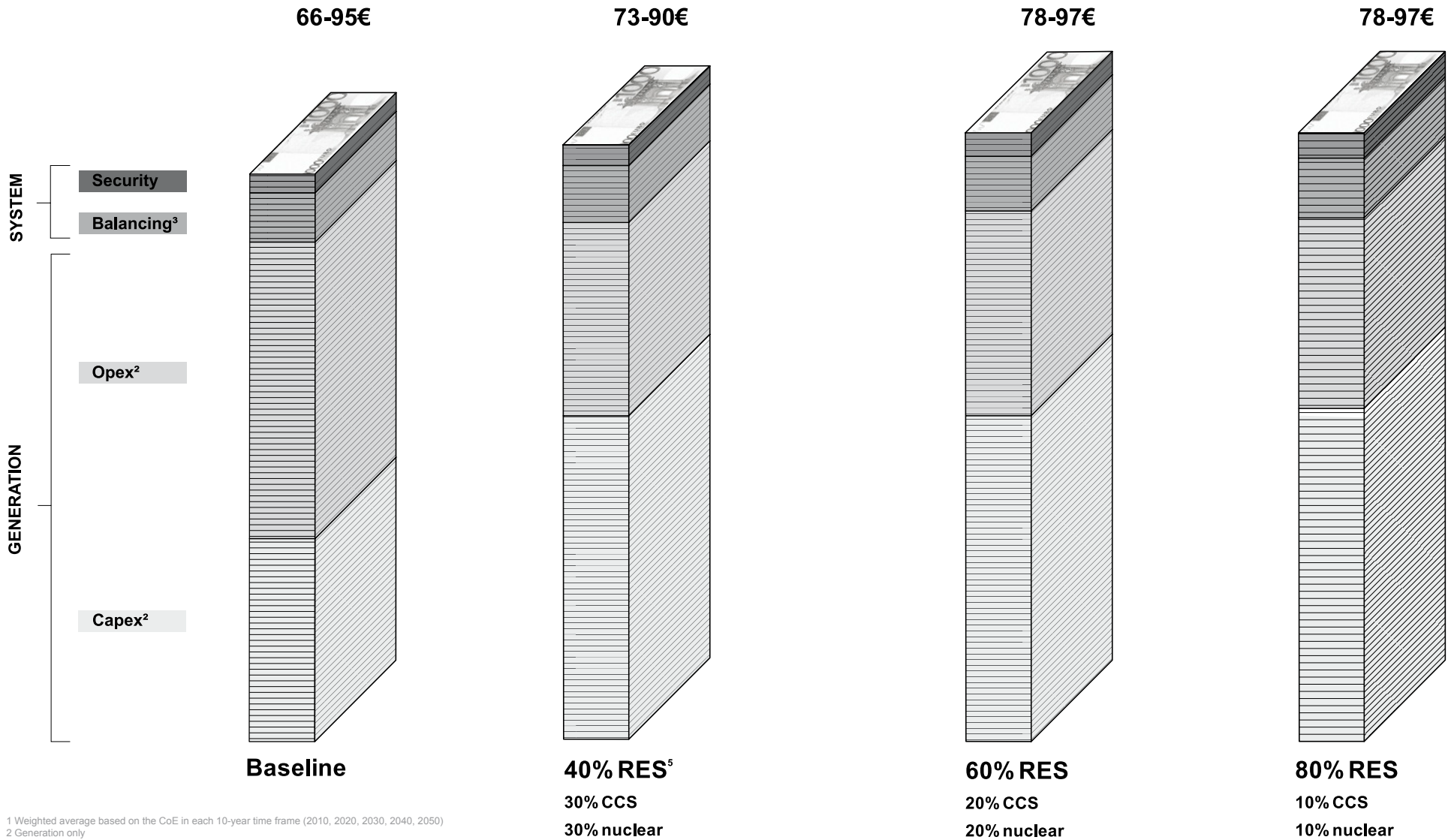
NOTE: Energy prices are a weighted average of prices faced by consumers weighted by the shares of consumption of different fuels

SOURCE: Roadmap 2050 Technical Analysis

# COST OF ELECTRICITY

THE HIGHER CAPITAL COST IS OFFSET BY A LOWER OPERATIONAL COST.

Average new built CoE from 2010 to 2050<sup>1</sup>, EUR/MWh (real terms)

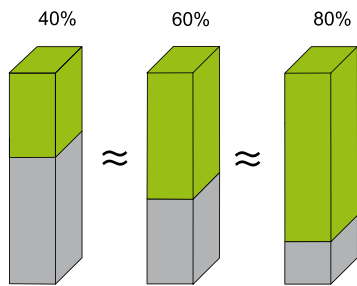


<sup>1</sup> Weighted average based on the CoE in each 10-year time frame (2010, 2020, 2030, 2040, 2050)  
<sup>2</sup> Generation only  
<sup>3</sup> Cost related to non optimal plant use, system dispatch cost for secure operation, running backup plants, storage losses, reserve and response cost  
<sup>4</sup> Transmission and additional generation capex as well as fixed opex for transmission and backup

SOURCE: Roadmap 2050 Technical Analysis

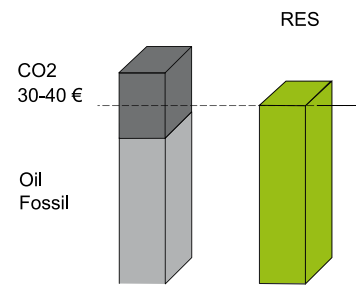
# COST OF ELECTRICITY

## COSTS TO CONSUMER ARE NEARLY THE SAME



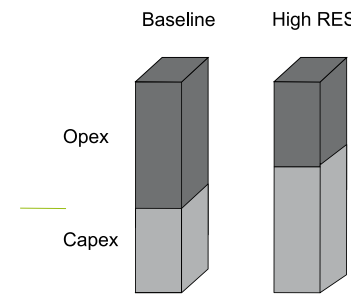
THE KEY FINDING FROM AGGREGATING CAPEX, OPEX, BACK-UP AND BALANCING COSTS AND GRID COSTS OVER THE NEXT FOUR DECADES IS THAT ALL THREE OF THE DECARBONISED PATHWAYS COST NEARLY/APPROXIMATELY THE SAME TO THE CONSUMER.

## FACTORING IN A CO2 PRICE



WHEN A CO2 PRICE OF 30-40 EUROS OR MORE IS INCLUDED, THE PRICE OF THE DECARBONIZED PATHWAYS IS THE SAME AS THE BASELINE PATHWAY.

## HIGH RES PATHWAYS MEAN LOWER OPEX



DECARBONIZED PATHWAYS ARE CHARACTERISED BY HIGHER CAPITAL EXPENDITURE AND LOWER OPERATING EXPENDITURE AND THE OPPOSITE IS TRUE IN THE BASELINE. INEVITABLY THOSE PATHWAYS WITH HIGHER FOSSIL FUEL DEPENDENCE ARE MORE SENSITIVE TO FUEL PRICE SHOCKS OR SIGNIFICANT INCREASES IN FUEL PRICES. THE DECARBONIZED PATHWAYS ARE MORE SENSITIVE TO INCREASES IN WEIGHTED COSTS OF CAPITAL AND TO DELAYS IN ACHIEVING EXPECTED LEARNING RATES FOR PRE-COMMERCIAL TECHNOLOGIES.

## COST IS NOT A BARRIER TO DECARBONIZED PATHWAYS

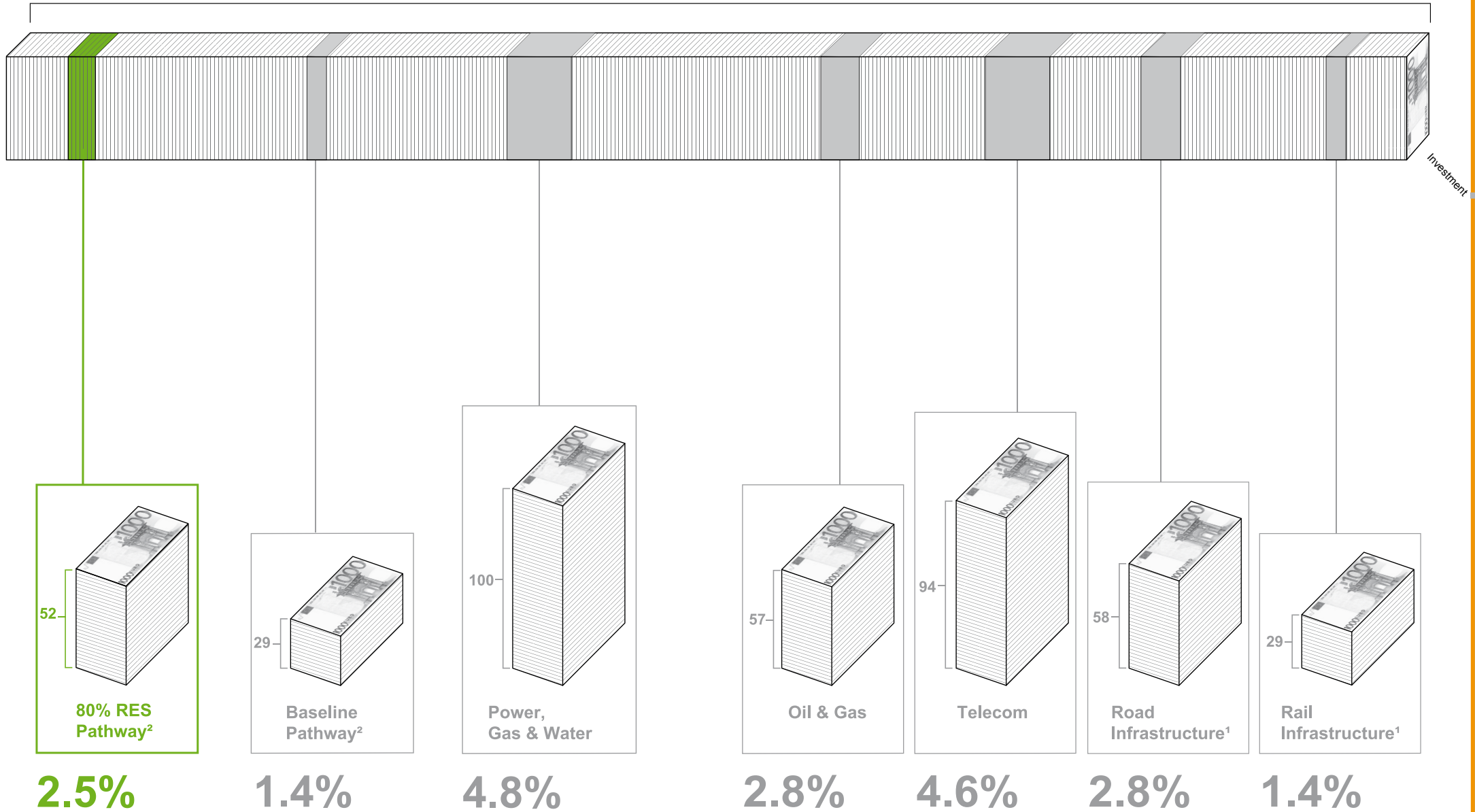


WE DID NOT EXPECT TO SEE THESE RESULTS - WE CAN CONCLUDE THAT CRITICAL POLICY DECISIONS CAN BE MADE ON ISSUES OTHER THAN ON THE HIGHER CAPITAL OF DECARBONIZED RESOURCES AND THAT THE TRANSMISSION COSTS ASSOCIATED WITH HIGH RENEWABLES PENETRATIONS ARE NOT A SIGNIFICANT COST BARRIER.

Cost of Electricity

# ANNUAL COST COMPARED TO EU SPENDING

Total European Investments  
2.059 Billion Euro



<sup>1</sup> Forecast for 2010 capex requirement not available for road and rail infrastructure investments; 2007 actual data is used instead  
<sup>2</sup> Average yearly capex requirement from 2011 to 2020

SOURCE: Roadmap 2050 Technical Analysis

# BASELINE COST COMPARISON

# €220 BILLION PER YEAR



# €220 BILLION PER YEAR



Baseline Cost

Baseline Cost SOURCE: Roadmap 2050 Technical Analysis

1) Wallstreet Bonuses in 2007 were \$38Billion (€28 Billion)  
2) The Congressional Research Service (CRS) estimate The War in Iraq to cost \$2 billion per week to \$12 billion (€9.16 billion) a month, an estimate by economist Joseph Stiglitz.  
(Assming: \$1.31 USD = €1)

SOURCE: www.bloomberg.com



# ADDITIONAL COST PER HOUSEHOLD

**€140**  
PER HOUSE HOLD  
PER YEAR



Per Capita Costs

DECARBONIZATION INVESTMENT COSTS  
OF **EUROPE** PER CAPITA

The additional capital cost per household (hh) per year is based on:  
Capex = 65 billion /yr  
Increase = 30 Billion / yr is 60 EUR pp/yr or 140 EUR per house hold

SOURCE: Roadmap 2050 Technical Analysis

# ADDITIONAL COST COMPARISONS

**€140**  
PER HOUSE HOLD  
PER YEAR

**€140**  
PER HOUSE HOLD  
PER YEAR



Per Capita Costs

Based on:  
Volkswagen Touareg 4WD SUV  
100Liter Fuel tank assuming a fuel price of 1.40EUR  
SOURCE: www.volkswagen.com

Manolo Blahnik Designer Shoes 500EUR pair  
SOURCE: www.neimanmarcus.com

INTERVIEW\_\_

KARIN HENRIKSSON\_\_  
BRUSSELS, BE  
15 MARCH 2010

## KARIN HENRIKSSON

PERMANENT REPRESENTATION OF SWEDEN TO THE EU  
CHAIR OF THE EDUCATION COMMITTEE, EDUCATION POLICIES, RESEARCH AND DEVELOPMENT POLICIES, RECOGNITION  
OF PROFESSIONAL QUALIFICATIONS, YOUTH.  
HENRIKSSON SAID THAT DURING NEGOTIATIONS LEADING UP TO THE EYCI, SHE HAD FELT STRONGLY THAT ATTENTION  
SHOULD BE GIVEN TO "SOMETHING IMPORTANT FOR EUROPE'S FUTURE". SHE SAID THAT THE SWEDISH PRESIDENCY HAD  
SUPPORTED FURTHER EDUCATION AND RESEARCH BY PROMOTING THE "KNOWLEDGE TRIANGLE".

## TANNER MERKELEY

OFFICE FOR METROPOLITAN ARCHITECTURE

TM: WE HAVE BEEN WORKING ON A EUROPEAN PROJECT FROM OUR OFFICE IN ROTTERDAM. AS I MENTIONED IN MY EMAILS, REM KOOLHAAS & REINIER DE GRAAF HAVE BEEN QUITE INVOLVED WITH PROJECTS IN THE EUROPEAN UNION FOR SOME TIME. THIS PROJECT FIRST BEGAN WITH AN INVESTIGATION OUR OFFICE MADE LAST YEAR, THE FEASIBILITY STUDY FOR A WIND FARM ON THE NORTH SEA, AND COINCIDENTALLY THE PROJECT RECEIVED QUITE A LOT OF PUBLIC AND PRIVATE INTEREST AND PUBLICITY.

SUBSEQUENTLY, AN ORGANIZATION CALLED THE EUROPEAN CLIMATE FOUNDATION BASED IN BRUSSELS AND DEN HAAG APPROACHED US TO WORK ON A PROJECT AIMED AT SHOWING HOW TO REDUCE EUROPEAN CO2 EMISSION LEVELS BY 2050. THE ECF ALSO HIRED MCKINSEY AND COMPANY TO DO A TECHNICAL ANALYSIS OF THE CURRENT TECHNOLOGY AND THE FEASIBILITY OF EUROPE TO SET TARGETS TO REDUCE THE EU'S CARBON FOOTPRINT AND MOVE AWAY FROM ITS DEPENDENCE ON FOREIGN FOSSIL FUELS.

ONE OF THE KEY FACTORS IN THE MCKINSEY TECHNICAL ANALYSIS WAS THAT THE EU HAS AN INCENTIVE TO GROW AND BECOME A LEADER IN THIS AREA. RESEARCH AND EDUCATION WOULD BE A CRUCIAL AREA TO INVEST-IN AND DEVELOP FURTHER. WE WANTED TO APPROACH YOU BASED ON YOUR EXPERIENCE WITH THE EUROPEAN PARLIAMENT AND YOUR SPECIALIZATION IN RESEARCH AND EDUCATION. WE WERE CURIOUS TO FIND OUT ABOUT THE EUROPEAN UNION'S EDUCATIONAL MASTER PLAN OR THE STRATEGIES UNDER DEVELOPMENT.

AT THE SAME TIME, THE EUROPEAN UNION IS IN AN INTERESTING POSITION BECAUSE THEY HAVE A HEAD START AND A LOT OF POTENTIAL ADVANTAGE OF, HOWEVER IF THEY DON'T TAKE INVESTMENT IN RESEARCH AND EDUCATION SERIOUSLY THEY COULD BE LEFT BEHIND BY COUNTRIES THAT SEE THE IMPORTANCE AND POTENTIAL IN THIS AREA (CHINA AND THE US PRIMARILY).

WE ARE CURIOUS TO KNOW MORE ABOUT YOUR ROLE AND HOW YOU ARE PART OF THE GREATER VISION FOR EUROPE? WE ARE ALSO INTERESTED IN HOW THE EU DEALS WITH CONTINUITY OF PLANNING AND VISION SINCE THE PRESIDENCY ROTATES EVERY 6 MONTHS. HOW DOES THE LARGER VISION OF THE EU MAINTAIN ITS CONTINUITY?

KH: YES, YES THESE ARE ISSUES WE DEAL WITH. IN TERMS OF PRESIDENCIES, WE JUST HAD OUR (SWEDEN) PRESIDENCY AND WE PLANNED THAT TOGETHER WITH THE CZECH REPUBLIC WHICH CAME BEFORE US AND NOW IT IS SPAIN, SO WE IN-FACT OVERLAP WITH THREE COUNTRIES IN THEIR PRESIDENCY AT ANY GIVEN TIME TO HELP MAINTAIN THE CONTINUITY. SPAIN IS NOW IN COOPERATION WITH BELGIUM AND HUNGARY.

IN AN AREA THAT I COULD TOUCH UPON THAT YOU ARE AFTER. 'SUSTAINABLE DEVELOPMENT' IS WHAT THEY CALL IT IN THE EU. THAT WILL NOW BE TAKEN UP BY BELGIUM DURING THEIR PRESIDENCY. THE QUESTION IS OF COURSE IS: WHAT WILL THE IMPACT BE IN THE FIELD OF EU EDUCATION DURING THE BELGIAN PRESIDENCY? IN THE FIELD OF EDUCATION THE EU DOES NOT HAVE ANY REAL AUTHORITY TOWARDS THE POLICIES OF MEMBER STATES. WHAT IS GOING ON AT THE MOMENT IS A LOT OF EXCHANGE OF INFORMATION & EXPERIENCE THAT WAS FORMALLY ACKNOWLEDGED SINCE THE LISBON SUMMIT IN 2000. THIS WAS THE MOMENT THAT THE EU DECIDED THAT THEY WERE GOING TO BE THE MOST COMPETITIVE KNOWLEDGE ECONOMY OF THE WORLD.

TM: THEN THE GOTHENBURG SUMMIT IN 2001 THAT WAS WHERE SUSTAINABILITY

REALLY BECAME A HIGH PRIORITY ON THE AGENDA.

KH: YES, EXACTLY.

BECAUSE FROM THE BEGINNING IN 2000 AT THE LISBON SUMMIT WHICH I WAS PART OF, IT WAS ABOUT COMPETITIVENESS AND IT WAS ABOUT ECONOMIC GROWTH. THEN DURING SWEDEN'S PREVIOUS PRESIDENCY IN 2001, WE ALSO MADE IT A TOP PRIORITY. SO EVER SINCE 2001 SWEDEN HAS BEEN FIGHTING ENSURE THAT SUSTAINABILITY HAS REMAINED AN IMPORTANT OBJECTIVE, WHICH HAS NOT ALWAYS BEEN THE CASE.

TM: I AM SURE IT HAS BEEN AN IMPORTANT TOPIC OF DISCUSSION THIS LAST YEAR, ESPECIALLY BECAUSE IT WAS THE EUROPEAN YEAR OF THE CLIMATE AND THERE WAS THE COPENHAGEN SUMMIT LAST AUTUMN.

KH: YES, THE ENVIRONMENT WAS ONE OF THE MAIN PRIORITIES OF THE SWEDISH PRESIDENCY IN 2001 AND IT WAS A PRIORITY ALSO IN 2009, AND WHAT PARTICULARLY HAPPENED WAS THAT SWEDEN HAD AN IMPORTANT ROLE AT THE CLIMATE SUMMIT IN COPENHAGEN, ALTHOUGH THAT WAS CHAIRED BY DENMARK AFTER-ALL, BUT SWEDEN WORKED A LOT WITH THE PREPARATIONS AND OF COURSE THE PRIME MINISTER HAD A ROLE IN IT AS THE 'LAST CHAIRMAN' OF THE EUROPEAN COUNCIL. HE AS ACTUALLY THE LAST ONE TO DO THAT BECAUSE NOW YOU HAVE VAN ROMPUY, THE BELGIAN WHO WAS ELECTED TO CHAIR THE EUROPEAN COUNCIL FOR TWO AND A HALF YEARS. SO SPAIN DOES NOT HAVE THE SAME ROLE IN THE EUROPEAN COUNCIL AS SWEDEN JUST HAD.

TM: SO THE EU IS BECOMING MORE INTEGRATED? COULD IT PERHAPS BE A MOVE FROM THE EUROPEAN UNION TO CREATE MORE CONTINUITY?

KH: YES WELL YOU COULD SAY THAT. ENSURING BETTER CONTINUITY WITHIN SIX MONTH PRESIDENCIES WAS ONE OF THEIR INTENTIONS; WHETHER THIS IS A GOOD SOLUTION STILL REMAINS TO BE SEEN. I AM NOT SO SURE IT REALLY IS, AND A LOT OF PEOPLE ARE SKEPTICAL. INITIALLY PEOPLE WERE AGAINST HAVING A CHAIR FOR THE EU COUNCIL. SOME THE PEOPLE WHO THOUGHT THEY MIGHT BE ELECTED, LIKE THE SWEDISH PRESIDENT AND OTHERS LIKE TONY BLAIR THOUGHT IT WAS A GOOD IDEA AND PROPOSED THAT THIS WOULD BE THE SOLUTION FOR THE FUTURE. (LAUGHTER) THAT IS THE WAY IT WORKS IN THE EUROPEAN UNION. SO NOW WE HAVE MR. ROMPUY AS CHAIR OF THE EUROPEAN COUNCIL. WE WILL SEE HOW IT WORKS OUT. OF COURSE IT IS ALWAYS IMPORTANT TO SEE HOW THE PRESIDENCIES REACT. THE PERMANENT CHAIR OF THE EUROPEAN COUNCIL WILL WORK CLOSELY WITH THE COMMISSION. AS FOR THE APPROACH TOWARD SUSTAINABILITY: THE LISBON STRATEGY WAS SET-UP UNTIL 2010 AND NOW THERE IS GOING TO BE A CONTINUATION OF THIS STRATEGY CALLED: 'EU 2020.'

TM: YES, THIS IS ONE OF THE PURPOSES OF THIS REPORT, TO HELP INFLUENCE THE CONSTRUCTION OF THIS NEW STRATEGY FOR THE NEXT DECADE AND THE NEXT 40YRS, AND OUR OBJECTIVE IS TO CREATE A REPORT THAT DEALS WITH THESE ISSUES.

I WAS READING A DEBATE RECENTLY ON A RELATED TOPIC WHERE I DISCOVERED THAT THE EU HAS A CLEAR AGENDA FOR THE COMING YEARS TO ENCOURAGE MORE PEOPLE TO STUDY ENGINEERING. APPARENTLY THE EU HAS DECIDED THAT ENGINEERING HAS THE MOST POTENTIAL FOR GROWTH, ESPECIALLY IN THE AREA OF SUSTAINABLE TECHNOLOGY. HOW IS THE EU

PLANNING TO IMPLEMENT THIS? WILL THIS MEAN A SERIES OF LARGE EU RESEARCH CENTERS OR UNIVERSITIES IN THE FUTURE?

KH: WHEN IT COMES TO ENSURING THAT THERE ARE ENOUGH STUDENTS IN MASTER OF SCIENCE PROGRAMS AND SO ON. THIS HAS BEEN A PREROGATIVE FOR THE EDUCATION MINISTERS FOR QUITE SOME TIME EVER SINCE OUR PREVIOUS PRESIDENCY (2001) BECAUSE WE HAD A MEETING FOR ALL MINISTERS OF EDUCATION AND RESEARCH. WE HAD A PRESIDENTIAL MEETING ABOUT THE FACT THAT THE NUMBER OF STUDENTS IN MOST MEMBER STATES WAS DECREASING IN THE MASTERS OF NATURAL SCIENCES. THIS WAS REALLY A PROBLEM FOR RESEARCH, BECAUSE IF YOU DO NOT HAVE ENOUGH STUDENTS THEN YOU DO NOT HAVE ENOUGH RESEARCHERS. SO THE MINISTERS OF EDUCATION EVENTUALLY AGREED ON A BENCH MARK FOR THE NUMBER OF GRADUATES IN THOSE SUBJECTS, WHICH ALSO INCLUDED STIMULATING WOMEN TO GO INTO THIS AREA.

TM: HOW WOULD THEY 'STIMULATE' IS IT THROUGH FUNDING OR OTHER INCENTIVES IN EARLIER DEVELOPMENT PROGRAMS BEFORE UNIVERSITY?

KH: YES, YOU NEED TO START QUITE EARLY. MANY COUNTRIES INCLUDING SWEDEN HAVE HAD DIFFERENT KINDS OF PROJECTS IN THE SCHOOLS TO TRY TO MOTIVATE YOUNG WOMEN TO GO INTO NATURAL SCIENCES. IN FACT SOME COUNTRIES HAVE DONE QUITE WELL. COUNTRIES LIKE IRELAND FOR INSTANCE HAVE DONE A GREAT JOB IN ATTRACTING YOUNG WOMEN INTO NATURAL SCIENCES.

IN THE BEGINNING THE NETHERLANDS SAID: 'THIS IS NOT IMPORTANT, WE DON'T NEED A BENCH MARK FOR GRADUATES IN SCIENCES.' THEY WERE STILL THINKING THAT COMMERCE AND TRADE IS WHAT THEY WOULD LIVE ON FOREVER AFTER. THEN JUST A YEAR OR TWO LATER THEY REALIZED THAT TECHNOLOGICAL COMPETITIVENESS WAS QUIET IMPORTANT. THIS WAS QUITE INTERESTING TURN OF EVENTS FOR EDUCATION ADMINISTRATORS. THE INITIAL POSITION THE NETHERLANDS TOOK ON THIS ISSUE BECAME THE BENCHMARK FOR THE EUROPEAN UNION. SO WE SET AN EU TARGET THAT WAS COMPARATIVELY QUITE LOW. AND IN LESS THAN A YEAR AND A HALF LATER WE ACHIEVED OUR TARGET. SO IT WAS A CONSERVATIVE STEP IN THE RIGHT DIRECTION, HOWEVER THAT DOESN'T MEAN THAT THE PROBLEM IS SOLVED. THERE IS STILL A SHORTAGE OF STUDENTS IN THIS AREA AND OF COURSE ENVIRONMENTAL ASPECTS ARE BECOMING MORE AND MORE IMPORTANT.

TM: ARE EU UNIVERSITIES STARTING TO DEVELOP MORE PROGRAMS THAT ARE GEARED TOWARDS ENVIRONMENTAL ISSUES? FROM MY OWN PERSONAL EXPERIENCE AND MSc. STUDY AT THE TU DELFT IN THE NETHERLANDS, I FELT THERE COULD BE MORE FOCUS ON SUSTAINABLE INNOVATION. FOR INSTANCE IN GERMANY THERE IS MUCH MORE INVESTMENT IN THIS AREA AND COMPANIES THAT ARE GLOBAL LEADERS IN PHOTOVOLTAIC TECHNOLOGY OR HEAT PUMPS HAVE BEEN ESTABLISHED IN GERMANY. DO YOU KNOW IF THERE ARE PLANS FOR THE EU TO CREATE SPECIALIZED MASTER OF ENGINEERING DEGREES THAT FOCUS ON RENEWABLE ENERGY DEVELOPMENT AND INNOVATION TO TRY AND FURTHER BUILD AN EU INDUSTRY AROUND SUSTAINABLE TECHNOLOGY? ANOTHER RELATED PROBLEM THAT COMES TO MIND IS THAT MANY UNIVERSITIES, ESPECIALLY THE ENGINEERING SCHOOLS SEEM TO HAVE AN ENTRENCHED WAY OF WORKING. THEIR HIERARCHICAL STRUCTURE MAY BENEFIT FROM SOME SORT OF INCENTIVE PROGRAM TO HELP ENCOURAGE INNOVATIVE CUTTING-EDGE RESEARCH IN EU ENGINEERING SCHOOLS.

KH: IT IS REALLY DIFFICULT, BECAUSE IF YOU LOOK STRICTLY AT EDUCATION, THEN THE EUROPEAN UNION DOES NOT REALLY HAVE ANY POWER OR AT LEAST CANNOT ENFORCE POLICIES ON MEMBER STATES.

TM: YES TRUE, HOWEVER THE EU DOES DISTRIBUTE FUNDING TO THE MEMBER STATES. CAN THE FUNDING POLICY BE USED AS A TOOL TO HELP ENCOURAGE AND SUPPORT MORE SUSTAINABLE INNOVATION?

KH: YES, WHEN IT COMES TO RESEARCH IT IS A LITTLE BIT DIFFERENT. BECAUSE THE EUROPEAN UNION HAS MORE INFLUENCE IN THE FIELD OF RESEARCH AND THE RIGHT TO PROPOSE COORDINATED POLICIES. THERE IS QUIET A LOT OF MONEY SET ASIDE BY THE EUROPEAN UNION FOR RESEARCH PROJECTS. ALMOST ALL OF THAT IS PUT INTO WHAT IS NOW CALLED 'THE SEVENTH FRAMEWORK PROGRAM' AND WILL BE EVENTUALLY 'THE EIGHTH FRAMEWORK PROGRAM' AND SO ON. I THINK IT HAS A TOTAL OF OVER 50 BILLION EUROS DISTRIBUTED FOR A SEVEN YEAR PERIOD AND IS GROWING EACH YEAR. WITHIN THE FRAMEWORK PROGRAM THERE ARE DIFFERENT TYPES OF PRIORITIES SET UP, AND SUSTAINABILITY IS ONE OF THOSE AREAS. SO THERE IS THE POSSIBILITY OF COURSE FOR THE EUROPEAN UNION TO STIMULATE RESEARCH AND COOPERATION IN THE FIELD OF RESEARCH BETWEEN INSTITUTIONS IN DIFFERENT COUNTRIES. I AM NOT SO FAMILIAR WITH DETAILS OF SPECIFIC PROJECTS, BECAUSE MY SPECIALTY IS IN DECISION MAKING, AND I AM NOT INVOLVED IN PROGRAM IMPLEMENTATION. HOWEVER I DO KNOW THERE IS A LOT OF INTERESTING PROGRAMS HAPPENING IN THE FRAMEWORK PROGRAM, AND A LOT OF MONEY INVESTED IN IT. HOWEVER IT IS DIFFICULT TO GET ACCESS THE MONEY BECAUSE THE PROCEDURES ARE VERY COMPLEX AND THERE IS A LOT OF BUREAUCRACY AROUND THE APPLICATIONS PROCESS.

TM: ARE THESE FUNDS AVAILABLE FOR STUDENTS, INDIVIDUALS, COMPANIES OR INSTITUTIONS?

KH: YES, WELL A COMBINATION OF RESEARCH INSTITUTES AND IT OF COURSE VARIES BETWEEN DIFFERENT COUNTRIES. IN SWEDEN A LOT OF RESEARCH IS CARRIED OUT WITHIN THE UNIVERSITIES. HOWEVER THIS IS NOT THE CASE IN GERMANY FOR EXAMPLE, SO IT DEPENDS ON HOW THE RESEARCH SYSTEM IS ORGANIZED IN THE DIFFERENT MEMBER STATES. A RESEARCH INSTITUTE OR A UNIVERSITY COULD BE A PRIVATE COMPANY OR A PUBLIC INSTITUTION. THERE IS A DEFINITE PRIORITY FOR THE EUROPEAN UNION TO STIMULATE SMALL OR MEDIUM SIZE BUSINESSES. THE BIG ONES NOT SO MUCH BECAUSE THE BIG ONES KNOW THEY HAVE TO INVEST AND THEY HAVE THE MONEY TO DO IT. BUT THE SMALL AND MEDIUM SIZED ENTERPRISES ARE THE ONES THAT CAN BENEFIT THE MOST FROM THE FUNDS, AND YOU ALWAYS TRY TO REACH THEM EVERYONE BUT THAT IS NOT VERY EASY. THESE ARE SOME OF THE MANDATES OF THE FRAMEWORK PROGRAM AND SIMILAR PROGRAMS.

TM: IS A LOT OF THE FRAMEWORK FUNDING EARMARKED FOR NEW TECHNOLOGY

OR SUSTAINABLE DEVELOPMENT? OR DOES IT FOCUS ON A MORE BROAD TYPE OF RESEARCH FUNDING?

KH: WELL THERE ARE DIFFERENT AREAS OF PRIORITY, THERE IS SOME MONEY GOING TO THE SOCIAL SCIENCES. BUT ONE HAS TO REMEMBER THAT THE ORIGIN OF RESEARCH WORK AND FUNDING IN THE EUROPEAN UNION IS TO STIMULATE INDUSTRY AND TECHNOLOGICAL DEVELOPMENT. SO OTHER RESEARCH AREAS CERTAINLY THE SOFTER ONES (ARTS, SOCIAL SCIENCE...) RECEIVE FUNDS AFTER THE LION'S SHARE OF THE FUNDING IS DISTRIBUTED TO MEDICAL, TECHNOLOGY AND ENGINEERING. CURRENTLY, ENVIRONMENTAL ISSUES ARE BECOMING MORE AND MORE IMPORTANT IN THIS FRAMEWORK PROGRAM. TO ADDRESS SOME OF THESE DEVELOPMENTS A NEW ENTITY HAS BEEN CREATED CALLED: THE EUROPEAN INSTITUTE OF INNOVATION AND TECHNOLOGY (EIT) WHICH IS STILL BEING SET-UP YOU COULD SAY.

THIS WAS AN IDEA OF BARROSO THE PRESIDENT OF THE EUROPEAN COMMISSION IT CAME OUT IN ONE OF THE SUMMITS AND PEOPLE THOUGHT WHAT ON EARTH IS THIS?

TM: WOULD IT BE BASED ON A PARTICULAR LOCATION OR IS IT PLANNED TO BE SOMETHING MORE VIRTUAL?

KH: FROM THE BEGINNING NO ONE HAD A CLUE WHAT IT WAS GOING TO BE ABOUT. INITIALLY PEOPLE THOUGHT THAT BARROSO WANTS A EUROPEAN MIT. SURE ENOUGH IT WAS SOMETHING LIKE THAT. THE IDEA WAS THAT IT WOULD BE BASED SOMEWHERE IN EUROPE WITH LOTS OF EUROPEAN FLAGS ON IT AND MAYBE SOME FRENCH FLAGS. THE EUROPEAN COMMISSION STARTED TO ELABORATE THIS AND TRIED DEFINE WHAT IT WOULD BE MORE CLEARLY, BECAUSE FROM THE BEGINNING YOU ONLY HAD THE NAME. AS IT TURNED OUT THAT MEMBER STATES DID NOT LIKE THE IDEA OF JUST ONE INSTITUTE IN ONE PLACE, SO AT THE MOMENT THERE IS ONLY AN OFFICE (NOT A WHOLE INSTITUTE) PLACED IN BUDAPEST. IT WILL BE INTERESTING TO SEE WHAT BECOMES IF THE EIT IN THE FUTURE.

THERE ARE ALWAYS TWO THINGS THAT CAUSE YEARS OF NEGOTIATIONS IN THE EUROPEAN UNION ONE IS WHERE ARE WE GOING TO PLACE AN ADMINISTRATIVE OFFICE AND THE OTHER IS ABOUT LANGUAGES. SO AT THE MOMENT, THERE IS A CENTER FOR ADMINISTRATION WHERE THE BOARD MEMBERS MEET IN BUDAPEST. AND APPARENTLY SOME KNOWLEDGE AND INNOVATION CENTERS ARE BEING SETUP ACROSS EUROPE. ALL OF THIS IS IN A VERY EARLY PLANNING STAGE SO IT IS HARD TO TELL WHAT FORM IT WILL TAKE IN THE COMING YEARS. IT IS CLEAR THAT THE IDEA WILL BE BASED ON A KNOWLEDGE TRIANGLE THAT WORKS WITH RESEARCH AND INNOVATION. ONE OF THE REASONS THE PROJECT IS STILL UNDER DEVELOPMENT IS THAT THERE WAS VERY LITTLE MONEY IN THE EU BUDGET FOR ANY ADDITIONAL PROJECTS. BARROSO HAD THIS IDEA AFTER THE SEVEN YEAR BUDGET WAS ALREADY DECIDED UPON. INITIALLY THE MINISTRIES OF FINANCE DIDN'T WANT TO GIVE A SINGLE PENNY TO ANYTHING NEW. NEVERTHELESS, THEY DID MANAGE TO FIND A COUPLE OF HUNDRED MILLION SOMEWHERE IN THE BUDGET TO GET THE PROJECT STARTED. OF COURSE THIS WAS NOT ENOUGH SO ONE OF THE IDEAS WAS THAT THE PRIVATE SECTOR WOULD BE A KEY PLAYER IN HELPING TO FINANCE THE PROJECT. IN SWEDEN'S CASE, THE ROYAL INSTITUTE OF TECHNOLOGY IS INVOLVED VERY MUCH IN ONE OF THESE RESEARCH CENTERS, AS WELL AS THE SEVENTH FRAMEWORK PROGRAM. THE ENVIRONMENT AND SUSTAINABILITY IS ONE OF THESE AREAS HIGHLIGHTED BY THE EUROPEAN INSTITUTE OF TECHNOLOGY

(EIT).

TM: THE IDEA OF A STAR INSTITUTION IN EUROPE SEEMS LIKE SUCH AN INTERESTING CONCEPT. OF COURSE INITIALLY IT APPEARS TO HAVE SOME DRAWBACKS, BECAUSE IT COULD COMPETE WITH THE MANY TOP TIER INSTITUTES WITHIN THE MEMBER STATES. HOWEVER, PERHAPS THIS IT IS JUST A QUESTION OF ORGANIZATION IN A WAY THAT STRENGTHENS ALL THE OTHER INSTITUTES BY CONNECTING THEM AND WHILE FORMING A NEW PRESTIGIOUS BRAND. I KNOW FROM AN INTERNATIONAL EDUCATIONAL PERSPECTIVE, HAVING A MORE STREAMLINED SET OF OPTIONS MAKES IT EASIER AND MORE ATTRACTIVE TO FOREIGN STUDENTS. AS WE COULD IMAGINE, FROM AN EU PERSPECTIVE THE BENEFITS OF ESTABLISHING A GLOBAL MAGNET FOR RESEARCH AND EDUCATION COULD HAVE NUMEROUS OTHER POSITIVE IMPLICATIONS.

COULD IT ALSO BE POSSIBLE TO SAY DIVIDE EUROPE INTO REGIONS EACH WITH A RESEARCH HUB, CONNECTED TO THE SAME INSTITUTION. PERHAPS THE CENTERS COULD BE SET UP FOR RESEARCH AND INNOVATIONS IN REGIONS WHERE IT MAKES SENSE TO DEVELOP THE APPROPRIATE TECHNOLOGY. IT COULD STILL BE ONE INSTITUTE, BUT WITH DIFFERENT FACULTIES IN DIFFERENT EU REGIONS. FOR EXAMPLE IN SPAIN WOULD PROBABLY BE A BETTER PLACE TO START TO DEVELOP SOLAR TECHNOLOGY THAN GERMAN FOR INSTANCE. CAN YOU GIVE SOME INSIGHT INTO SOME OF THE IDEAS BEHIND THE VISION FOR EIT?

KH: THERE WILL DEFINITELY BE THESE CENTERS, KNOWLEDGE AND INNOVATION CENTERS, THEY ARE STILL DEVELOPING BUT EVENTUALLY THERE WILL BE CENTERS WORKING ON DIFFERENT AREAS. I AM SURE THERE WILL BE ONE WORKING ON ENVIRONMENT FOR EXAMPLE. THAT IS PROBABLY WELL ON THE WAY. I KNOW OF COURSE FOR SEVERAL YEARS THERE HAVE BEEN EFFORTS MADE TO STIMULATE JOINT DEGREES FOR EXAMPLE AND LOTS OF DEVELOPMENT WORK GOING ON IN PROJECTS FINANCED BY THE EUROPEAN UNION AND ALSO A SPECIAL PROGRAM IN THE FIELD OF EDUCATION WHICH IS BASED ON UNIVERSITIES OFFERING JOINT DEGREES. FIRST AND FOREMOST IT STILL NEEDS PARTS FROM THE OTHER WORLD. UNIVERSITIES GET SUBSTANTIAL GRANTS THROUGH THIS PROGRAM, IN ORDER FOR EUROPE TO ATTRACT THE BEST STUDENTS FROM OTHER PARTS OF THE WORLD INSTEAD OF THE UNITED STATES. EUROPEAN STUDENTS CAN BE INVOLVED TOO, BUT THE PRIORITY IS TO ATTRACT THE BEST STUDENTS FROM INDIA & CHINA.

TM: CAN YOU EXPLAIN THE EU SYSTEM FURTHER. IT SEEMS A BIT DIFFERENT FROM THE SYSTEM IN THE UNITED STATES. THERE THEY ESSENTIALLY PURCHASE AND SUPPORT TOP PROFESSORS AND RESEARCHERS AND THE STUDENTS FOLLOW. IS THAT WHAT ONE OF THE APPROACHES THE EU IS CONSIDERING?

KH: NOT IN TERMS OF BUYING THE PROFESSORS. BUT THIS IS ONE WAY OF DOING IT. THE EU CHOOSES TO INCREASE THE ATTRACTIVENESS FOR EUROPEAN HIGHER EDUCATION, THROUGH COOPERATION WITH OTHER IMPORTANT INSTITUTIONS INSIDE AN OUTSIDE OF EUROPE. THE IDEAS BEGAN DURING OUR PREVIOUS PRESIDENCY AND HAVE BEEN UNDER DEVELOPMENT FOR THE LAST 6 YEARS. THIS IS JUST AN EXAMPLE OF WHERE THE THINGS ARE GOING. THE CONCEPT OF JOINT DEGREES IS SOMETHING WE HAVE BEEN WORKING ON EUROPEAN LEVEL, AND IT IS MUCH EASIER SAID THAN DONE. THE BIGGEST OBSTACLES ARE LANGUAGE AND LEGISLATION IN THE DIFFERENT COUNTRIES. COINCIDENTALLY SWEDEN REALLY PUSHED THIS IDEA IN 2001 AND TOLD EVERYONE ELSE THAT WE SHOULD HAVE EUROPEAN DEGREES AND JOINT

DEGREES, BUT SWEDEN COULD NOT PARTICIPATE IN THIS CONCEPT BECAUSE OUR LEGISLATION DID NOT ALLOW IT AT THAT TIME, IT DOES NOW. ITALY WAS THE ONLY COUNTRY IN EUROPE THAT COULD JUST DO IT. BUT THAT IS CHANGING NOW.

WE STARTED OUR PRESIDENCY LAST SUMMER WITH SEMINAR WHICH HAD TO DO WITH THE IDEA OF HUBS, TO GET UNIVERSITIES TO WORK TOGETHER ACROSS BORDERS IN ORDER TO PROMOTE EXCELLENCE. ONE PROBLEM WE ENCOUNTERED WAS THAT IN EUROPE UNIVERSITIES ARE ABOVE THINGS LIKE EXCELLENCE AND MONEY. UNIVERSITIES SEE THEMSELVES AS A PUBLIC GOOD. THEY JUST DID NOT WANT TO EVEN DISCUSS HOW TO PROMOTE EXCELLENCE, BECAUSE THAT ULTIMATELY MEANS YOU CAN NOT PROMOTE ALL YOUR INSTITUTIONS EQUALLY OF COURSE.

TM: THAT IS AN INTERESTING DILEMMA.

KH: IN ALL COUNTRIES THERE ARE HIGHER EDUCATION INSTITUTIONS WHICH HAVE BEEN SET UP TO STIMULATE REGIONAL DEVELOPMENT, THE INSTITUTIONS ARE NOT NECESSARILY DESIGNED TO BECOME THE BEST UNIVERSITIES OR TO HAVE WORLD CLASS RESEARCH FACILITIES, BUT TO SERVE TO LOCAL WORKFORCE AN REGIONAL POPULATION. IN SWEDEN WE HAVE A NUMBER OF UNIVERSITIES WHICH ARE SPREAD ACROSS THE COUNTRY AS DO MOST EUROPEAN COUNTRIES. ONE OF THE BIGGEST PROBLEMS IS THAT THERE ARE TOO MANY HIGHER EDUCATION INSTITUTIONS IN EUROPE, MORE THAN WE NEED AND MORE THAN COULD EVER BECOME EXCELLENT THAT IS FOR SURE.

THE TREND IN SWEDEN IS THAT YOU WILL SEE MORE MERGERS BETWEEN HIGHER EDUCATION INSTITUTIONS AND UNIVERSITIES. THEY SIMPLY CANNOT ACHIEVE THE CRITICAL MASS THEY NEED IN TERMS OF RESOURCES. THAT IS ONE REASON AND ANOTHER IS THAT THE NUMBER OF STUDENTS WILL BE DECREASING IN SOME YEARS.

TM: THERE WAS EVEN A DEBATE IN NETHERLANDS TO COMBINE EINDHOVEN TECHNICAL UNIVERSITY WITH DELFT AND BASICALLY WHAT THEIR PLAN IS TO PUT ALL THE CIVIL ENGINEERING IN ONE INSTITUTE AND CHEMICAL ENGINEERING IN THE OTHER SO THEY CAN COMBINE THE INFRASTRUCTURE. I THINK IT IS AN INTERESTING IDEA, BUT IF YOU ACTUALLY THINK ABOUT IT, THE TU DELFT ALREADY QUITE A BIG INSTITUTION. FOR INSTANCE THE FACULTY OF ARCHITECTURE IS ALREADY OVER 3000 STUDENTS. THIS CAN OFTEN BE A BIT IMPERSONAL OR OVERWHELMING TO SOME. SO ANOTHER INTERESTING QUESTION IN REGARDS TO EXCELLENCE IS DO YOU INCREASE THE QUANTITY, OR TRY TO FOCUS ON BRINGING THE BEST AND BRIGHTEST TOGETHER?

KH: THAT DISCUSSION IS CERTAINLY GOING ON. THOSE UNIVERSITIES WHO REALIZE AND I SHOULD MENTION THAT NOT ALL UNIVERSITIES UNDERSTAND THIS POINT WHICH IS SURPRISING. HOWEVER THOSE WHO DO, REALIZE THAT THEY HAVE TO DO SOMETHING IN ORDER TO BE PREPARED FOR THE FUTURE. AND WHEN I SAY THE FUTURE I AM TALKING ABOUT THE DEMOGRAPHIC PROBLEM OF FEWER STUDENTS WHICH TRANSLATES TO FEWER RESOURCES.

TM: YES, THE POPULATION DECLINE IN EUROPE IS ANOTHER INTERESTING TOPIC.

KH: DEFINITELY, NOT SO MUCH IN SWEDEN BUT SPAIN AND ITALY THEY ARE

GOING TO HAVE HUGE PROBLEMS. OF COURSE IT IS DEVELOPMENT EVERYWHERE, BUT IT IS LESS SERIOUS IN SWEDEN AS WILL BE IN ITALY FOR EXAMPLE. NEVERTHELESS THEY HAVE TO DO SOMETHING AND OF COURSE THIS IS BEING DISCUSSED A LOT NOW. BUT TO GO BACK TO THE TOPIC OF EXCELLENCE; TO ACHIEVE EXCELLENCE WE MUST IMPROVE YOUR PERFORMANCE IN ORDER TO STAY GLOBALLY COMPETITIVE. UNIVERSITIES WILL HAVE TO STOP OFFERING EVERYTHING AND THAT HAS BEEN THE CASE ALL OVER THE EUROPE. ALMOST ALL HIGHER EDUCATION INSTITUTIONS WHETHER THEY CALL IT UNIVERSITIES OR COLLEGES TEND TO OFFER EVERYTHING UNDER THE SUN, AND THAT WILL CHANGE.

TM: I DID A WORKSHOP WITH THE ETH (SWISS FEDERAL INSTITUTE FOR TECHNOLOGY) IN ZURICH AND I NOTICED THAT THEY WERE RELATIVELY STRICT ABOUT WHAT THEY OFFERED. AND IF YOU DO A PHD YOU FALL INTO VERY CLEAR RESEARCH TOPIC WHERE A HIERARCHICAL ORGANIZATION OF PROFESSORS AND ASSISTANTS ALL WORK TOWARDS ONE VERY SPECIFIC RESEARCH AREA. OF COURSE IT ALSO HAS ITS DRAWBACKS BUT IT WAS INTERESTING THAT THE STATE FUNDED INSTITUTION WAS QUITE PRECISE ABOUT HOW IT DIRECTED ITS RESEARCH FUNDING.

IN ORDER TO IMPLEMENT THIS YOU SHOULD NOT GO TO THE COUNCIL OF MINISTERS BECAUSE THEY ARE NOT PREPARED. IT HAS TO BE PROPOSED BY THE EUROPEAN COMMISSION FOR THE MINISTERS TO ACTUALLY DEAL WITH A SPECIFIC QUESTION.

ONE OF THE LAST QUESTIONS WE WERE WONDERING IS WHAT MOTIVATES POLITICIANS? THERE ARE SO MANY ROADMAPS, REPORTS THAT COME ACROSS PEOPLES' DESKS. WE IMAGINE THAT THERE MUST BE PILES OF REPORTS THAT NEVER MAKE IT TO THE POLICY LEVEL. ONE OF THE REASONS EUROPEAN CLIMATE FOUNDATION GOT MCKINSEY AND COMPANY ON THE BOARD IS THAT PEOPLE WILL START TO THINK, MCKINSEY DID THE ANALYSIS AND IT MIGHT BE THE BEST WE HAVE AVAILABLE, SO IT IS WORTH HAVING A LOOK. MCKINSEY MADE A POINT OF ALSO WORKING EXTENSIVELY WITH INDUSTRY TO UNDERSTAND THEIR CONCERNS AND TO GET REALISTIC APPRAISAL SUSTAINABLE DEVELOPMENT IN EUROPE.

KH: WITH POLITICIANS IN MEMBER STATES THERE IT REALLY DEPENDS ON WHAT THEIR DOMESTIC AGENDA IS AND WHAT PRIORITIES THEY HAVE AND WHAT THEY THINK THEY CAN ACHIEVE. BUT AT EUROPEAN LEVEL YOU HAVE TO GET THE COMMISSION ON BOARD SOMEHOW. THE COMMISSION IS THE GROUP THAT WILL ENSURE THAT THE MESSAGE IS CONVEYED TO THE MINISTERS AND I SUPPOSE IN THIS CASE IT WOULD BE THE ENERGY COUNCIL.

IN ORDER TO IMPLEMENT THIS OF COURSE YOU SHOULD NOT GO TO THE COUNCIL OF MINISTERS BECAUSE THEY ARE NOT PREPARED. IT HAS TO BE PROPOSED BY THE EUROPEAN COMMISSION FOR THE MINISTERS TO ACTUALLY DEAL WITH A SPECIFIC QUESTION. THE EUROPEAN PARLIAMENT IS IMPORTANT WHEN IT COMES TO INFLUENCING THE COMMISSION. IT IS ALWAYS THE COMMISSION THAT PROPOSES, BUT FOR THE COMMISSION TO HAVE IDEAS THEY HAVE TO USE THEIR OWN EXPERTS. THE COMMISSION ALSO PICKS UP IDEAS FROM A VARIETY OF SOURCES AND PRIORITY LEVELS AND IT USUALLY HELPS

IF THE EUROPEAN PARLIAMENT HAS BEEN PRESSING THE ISSUE. WHEN IT IS THE COMMISSION'S TASK TO PROPOSE SOMETHING TO THE MINISTERS THEY MEET IN THE COUNCIL OF MINISTERS. SINCE THE LISBON TREATY CAME INTO FORCE IT IS ALMOST ALWAYS THE CASE THAT THE COMMISSION PROPOSES OR SENDS A PROPOSAL TO THE COUNCIL OF MINISTERS AND TO THE EUROPEAN PARLIAMENT AT THE SAME TIME. IF THE EUROPEAN PARLIAMENT HAD THEIR REPORT FROM THE BEGINNING AND WAS ABLE TO DISCUSS IT AND CAME UP WITH IDEAS AND HAD HEARINGS. THEY VERY OFTEN HAVE HEARINGS IN THE EUROPEAN PARLIAMENT AND PRESS THE COMMISSION. THIS WAY THEY WILL GET THE FORMAL PROPOSAL BACK FROM THE COMMISSION AND START WORKING ON THAT IN PARALLEL WITH THE COUNCIL OF MINISTERS.

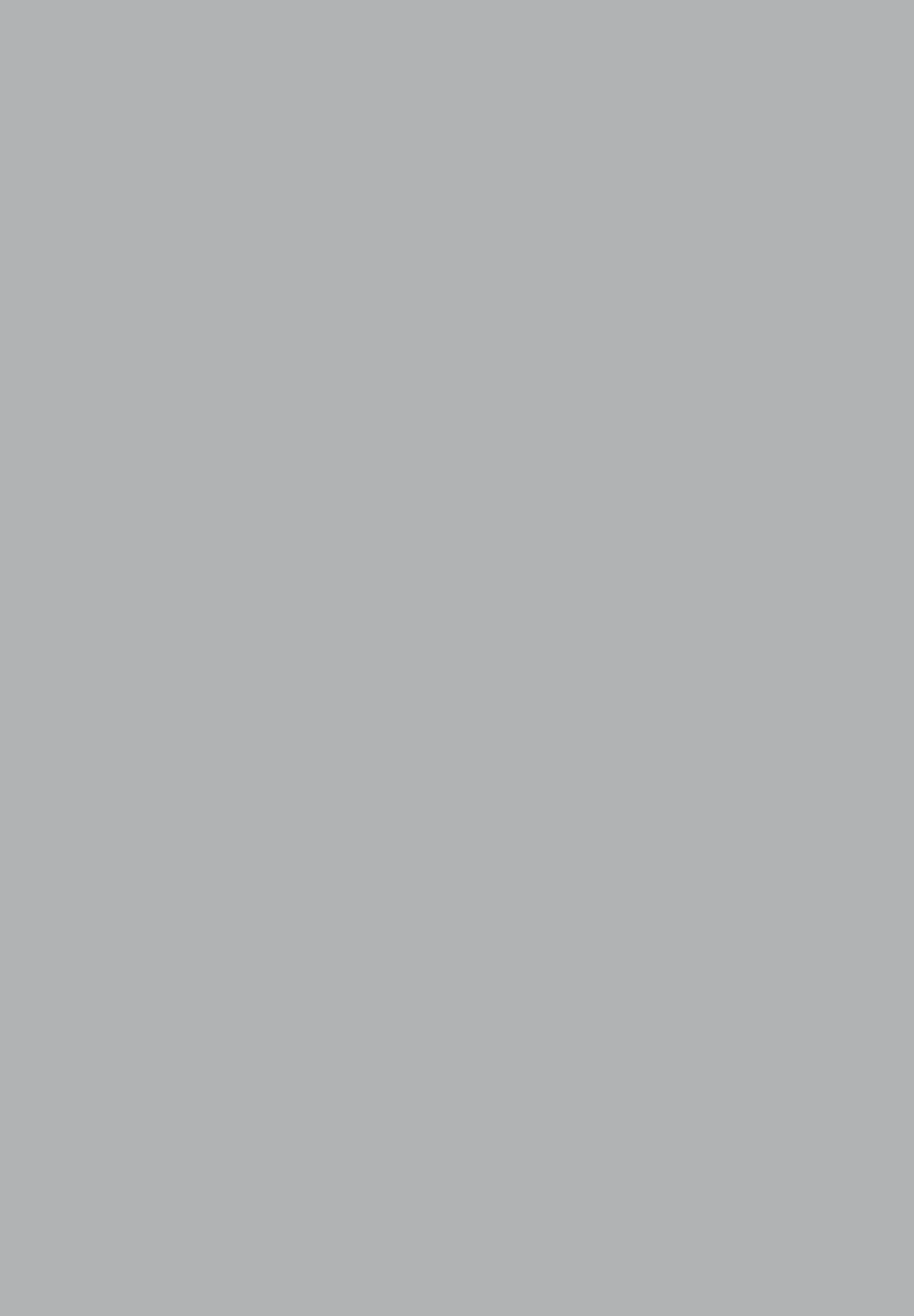
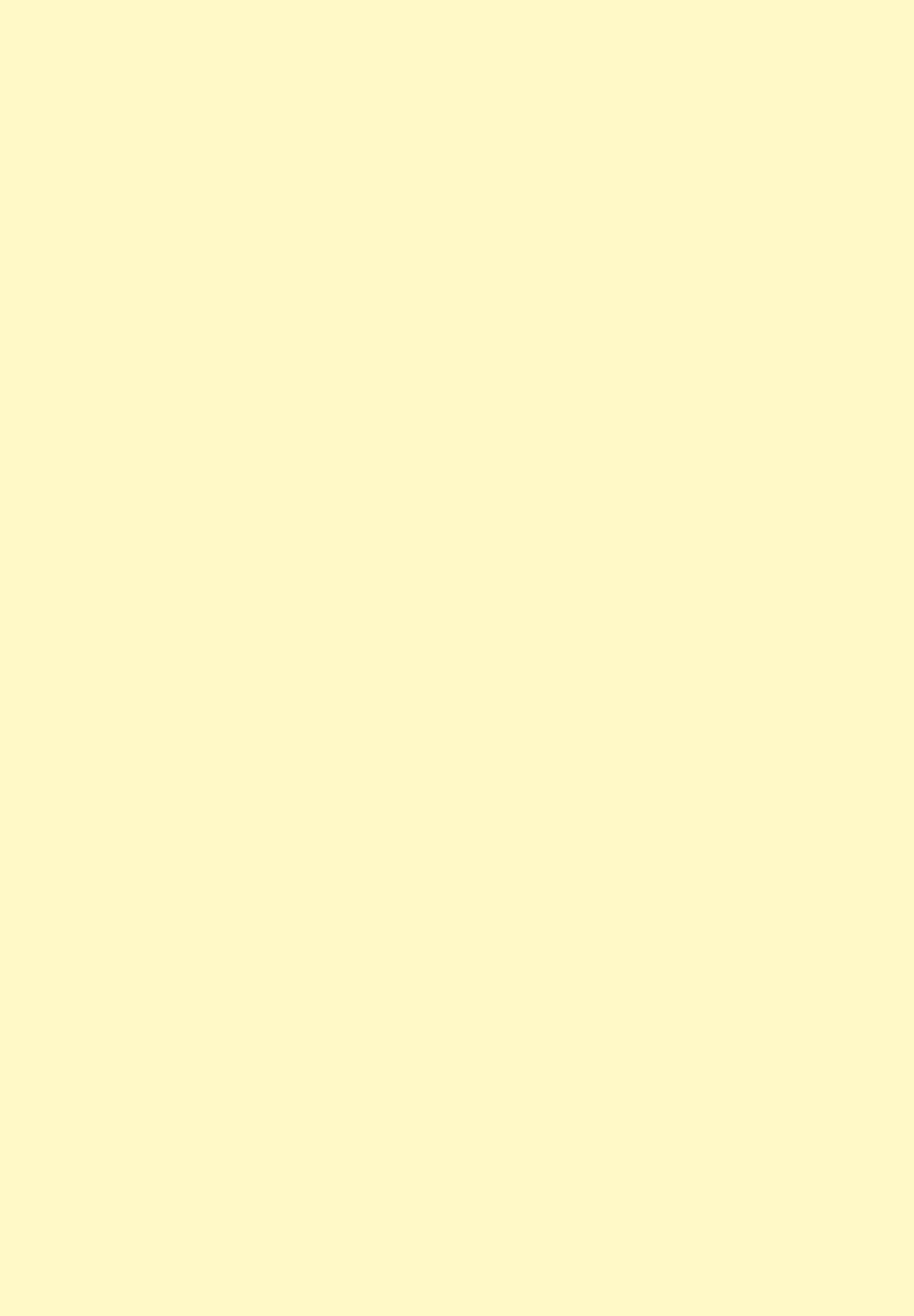
TM: SO THEY ALMOST NEED TO FIRST FOCUS ON THE EUROPEAN PARLIAMENT TO KEEP THEM UP TO DATE WITH THE RELEVANT FACTS AND CONCEPTS. WHAT ABOUT LOBBYING DIRECTLY TO THE COUNCIL OF MINISTERS?

KH: YOU DO NOT LOBBY IN THE COUNCIL OF MINISTERS, BECAUSE BY THAT POINT IT IS TOO LATE THE COUNCIL OF MINISTERS ONLY DEALS WITH DRAFT DECISIONS. BUT INSTEAD YOU DEFINITELY NEED TO LOBBY WITHIN THE EUROPEAN PARLIAMENT AND THE COMMISSION. ALSO INTERESTINGLY, UNDER THIS NEW COMMISSION THERE THEY HAVE SPLIT UP THE DIRECTOR GENERAL TO TAKE CARE OF ENERGY AMONG OTHER THINGS. SO THERE IS SPECIFIC PERSON DEALING WITH ENERGY AT THE MOMENT THAT COULD BE ANOTHER PROMISING WAY FORWARD, AS THEY WILL BE LOOKING FOR HIGH POTENTIAL PROJECTS TO FOCUS ON.

TM: THANK YOU FOR TAKING THE TIME TO GO THROUGH THIS WITH ME TODAY.

KH. IT WAS A PLEASURE TO HEAR YOUR PERSPECTIVE ON THE ISSUES. I WISH YOU ALL THE BEST.

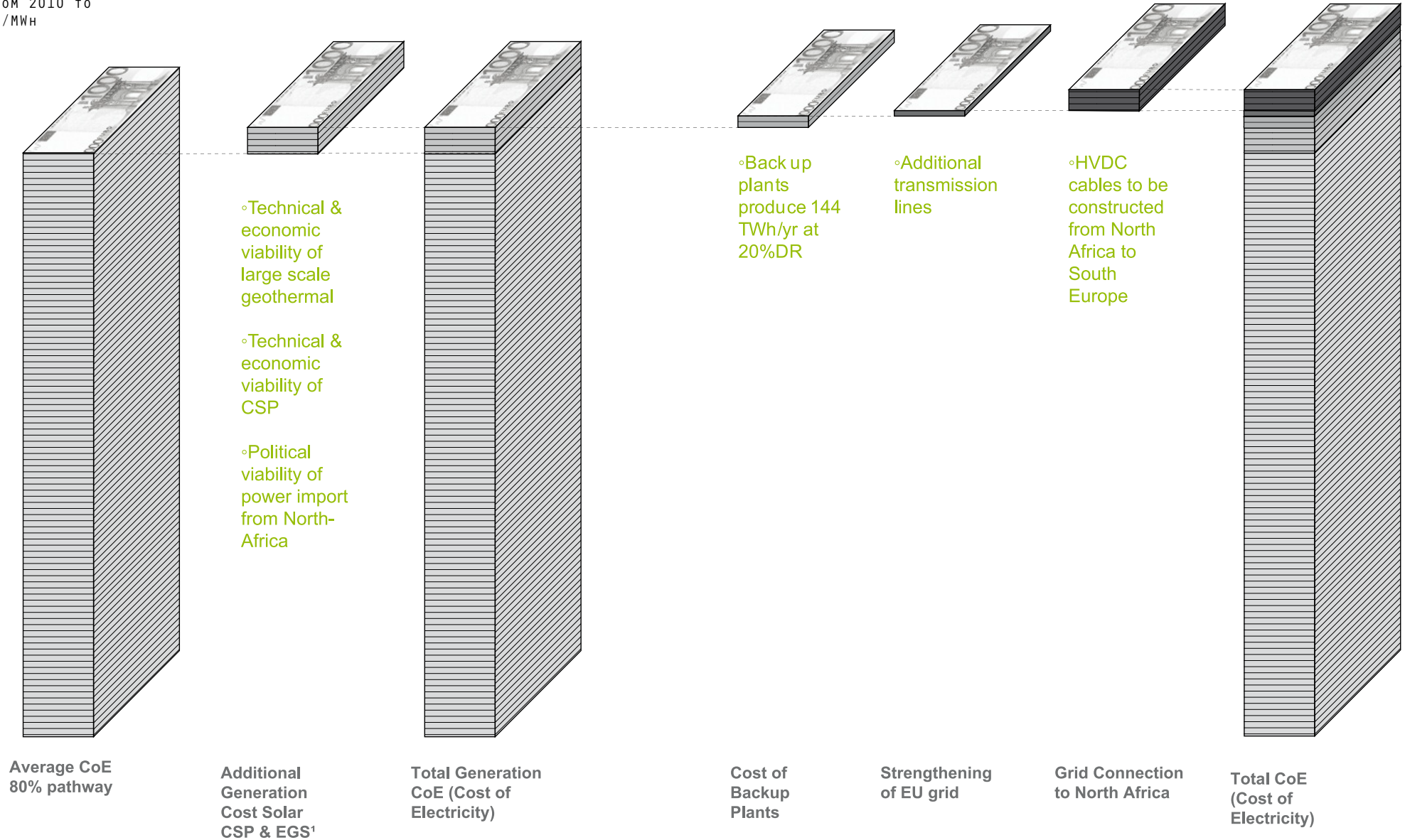




# 100% RES PATHWAY CoE (COST OF ELECTRICITY)

A 100% RES PATHWAY  
COULD BE ABOUT  
10% MORE COSTLY  
AND RELIES ON 15%  
IMPORT OF POWER  
FROM NORTH AFRICA

AVERAGE CoE OF NEW  
BUILDS FROM 2010 TO  
2050, EUR/MWH

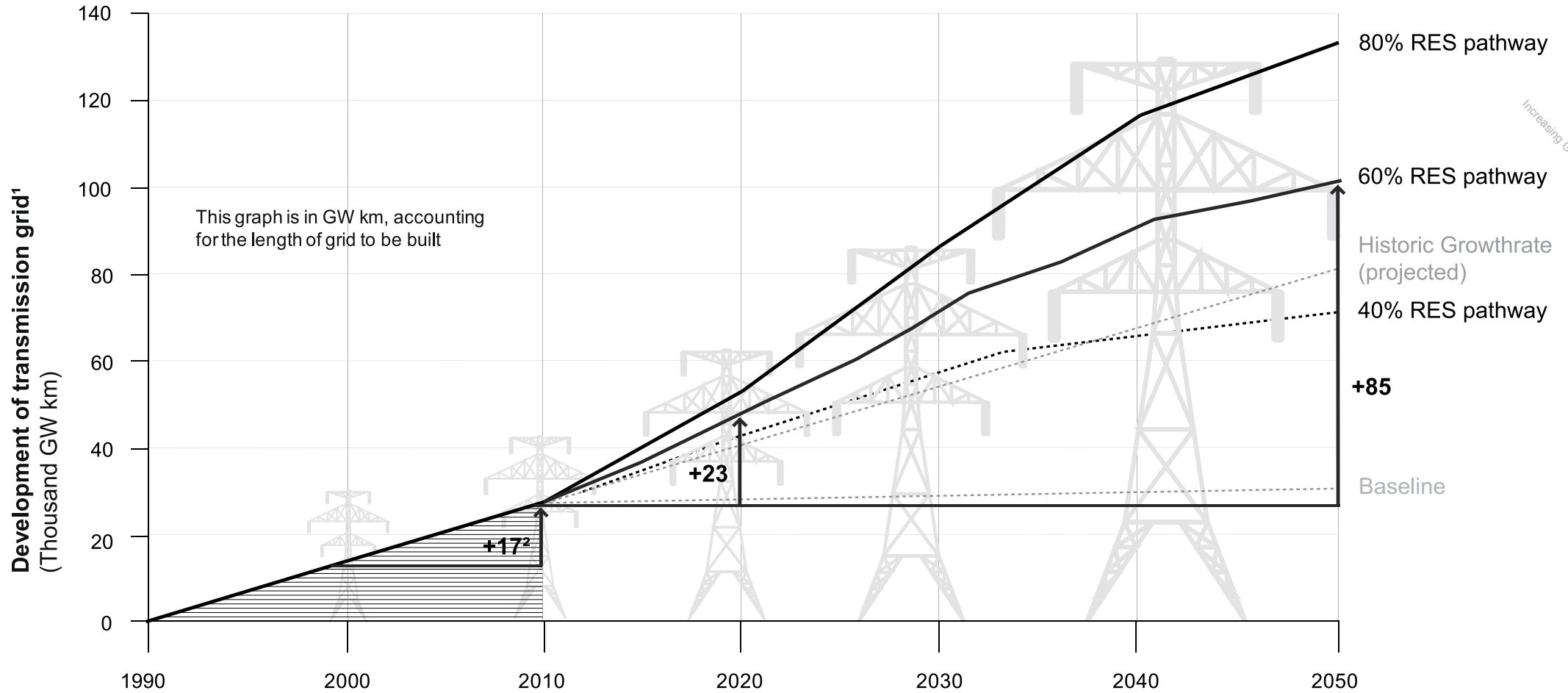


1) Coal (5%), gas (5%) and nuclear power (10%) replaced by 15% solar CSP from North-Africa (~700-800 TWh (similar as Desertec) and 5% enhanced geothermal (assumed to be spread over the region relative to the estimated potential). CSP CoE assumes 25% improved irradiation compared to Iberia. SOURCE: Roadmap 2050 Technical Analysis, Desertec

# INCREASE IN GRID CAPACITY

THE ROADMAP  
REQUIRES  
SIGNIFICANT  
DEVELOPMENT  
OF EUROPE'S  
TRANSMISSION  
GRID

20% DSM



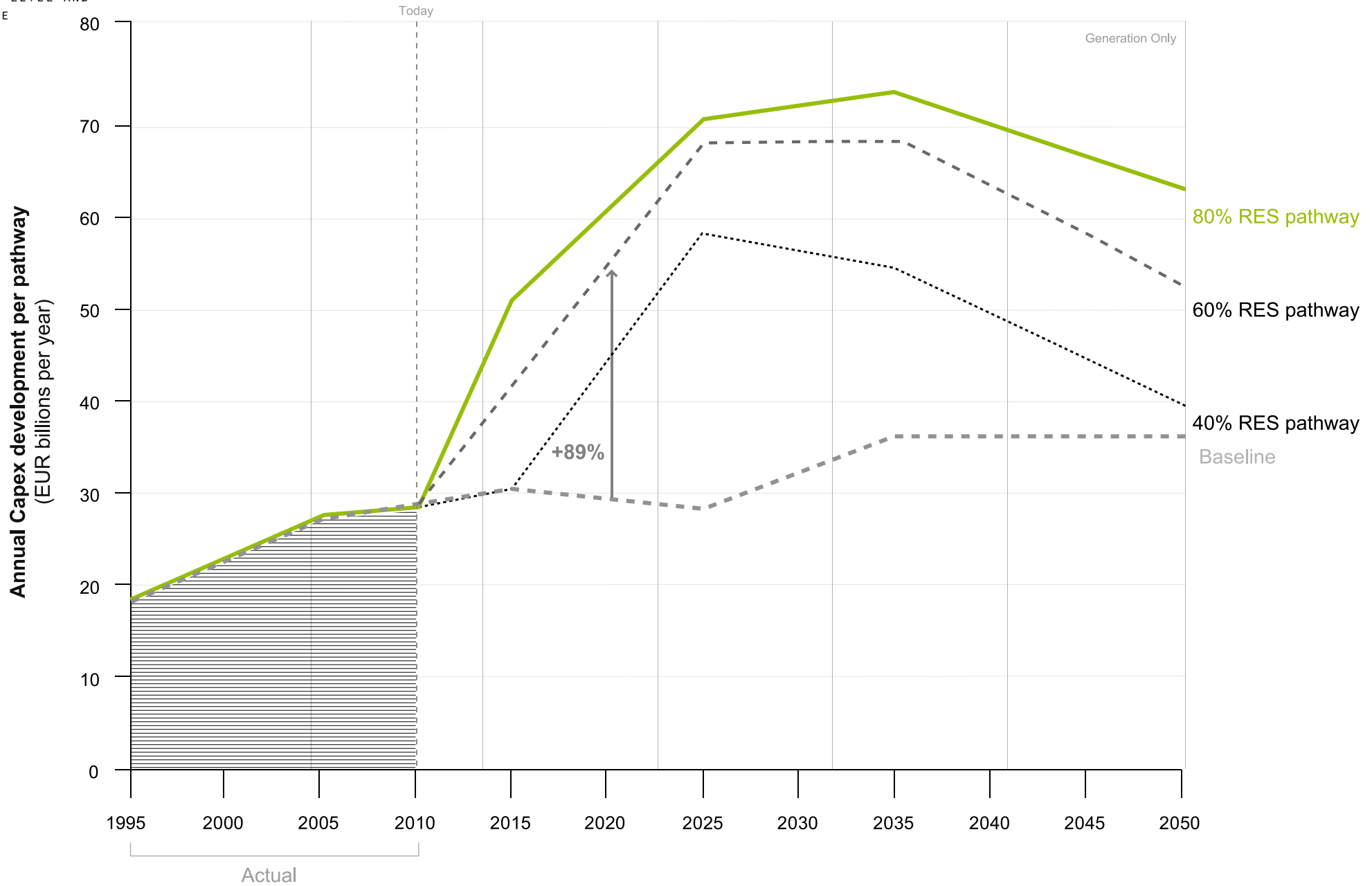
1 Development of grid is assumed to be driven by the penetration of intermittent power sources (solar PV, wind onshore and wind offshore)

2 This assumes a linear build up of grid capacity in thousand GW km between 1990 and 2010, starting at zero, although some grid has been built even before 1990, i.e. UK-France and much of the Central European interconnections

SOURCE: Roadmap 2050 Technical Analysis

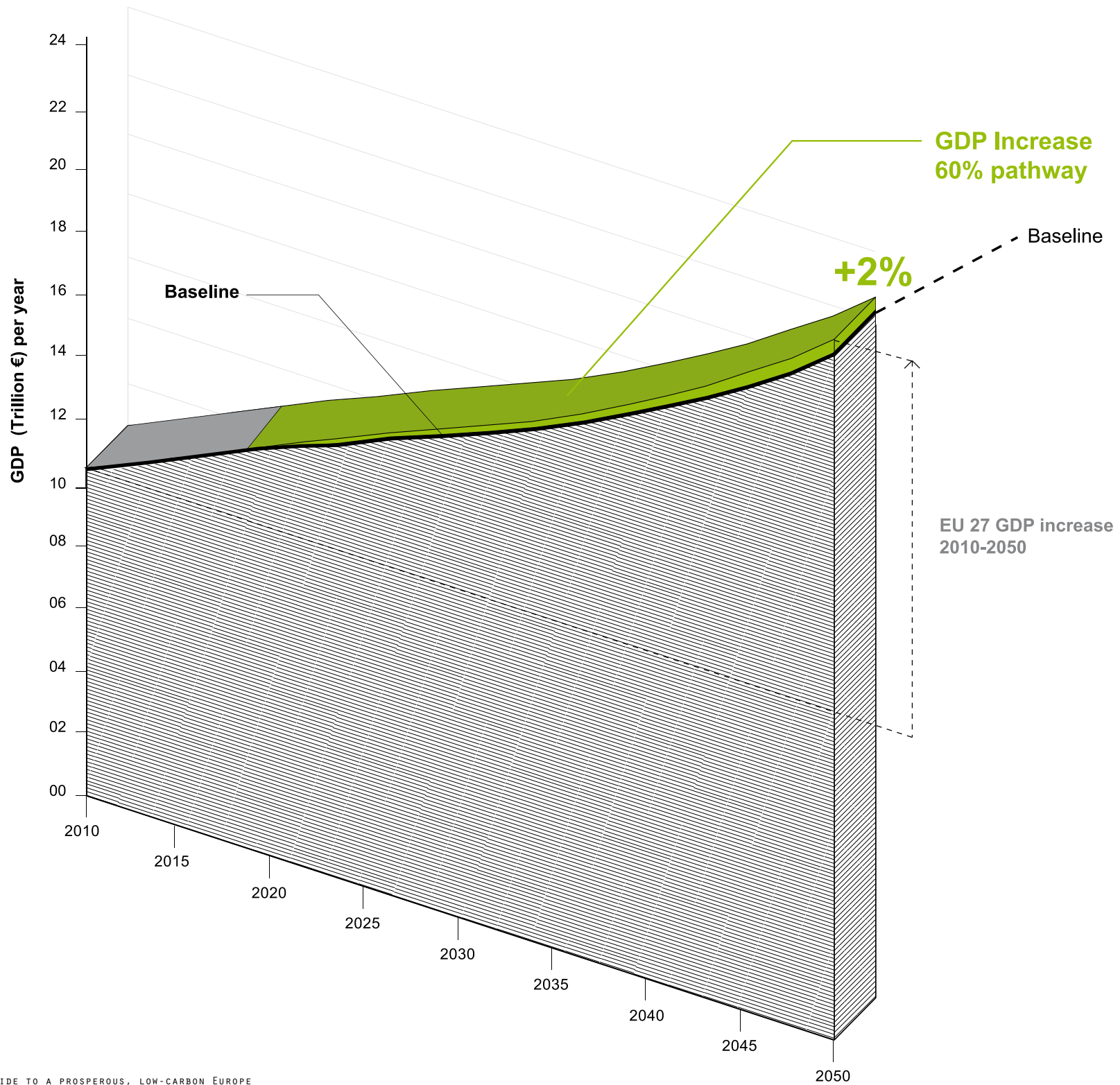
# ANNUAL CAPEX DEVELOPMENT

IN THE 60% RES  
PATHWAY, ANNUAL  
CAPEX REQUIREMENTS  
INCREASE BY 89%  
UNTIL 2020 COMPARED  
TO 2010 LEVEL AND  
BASELINE



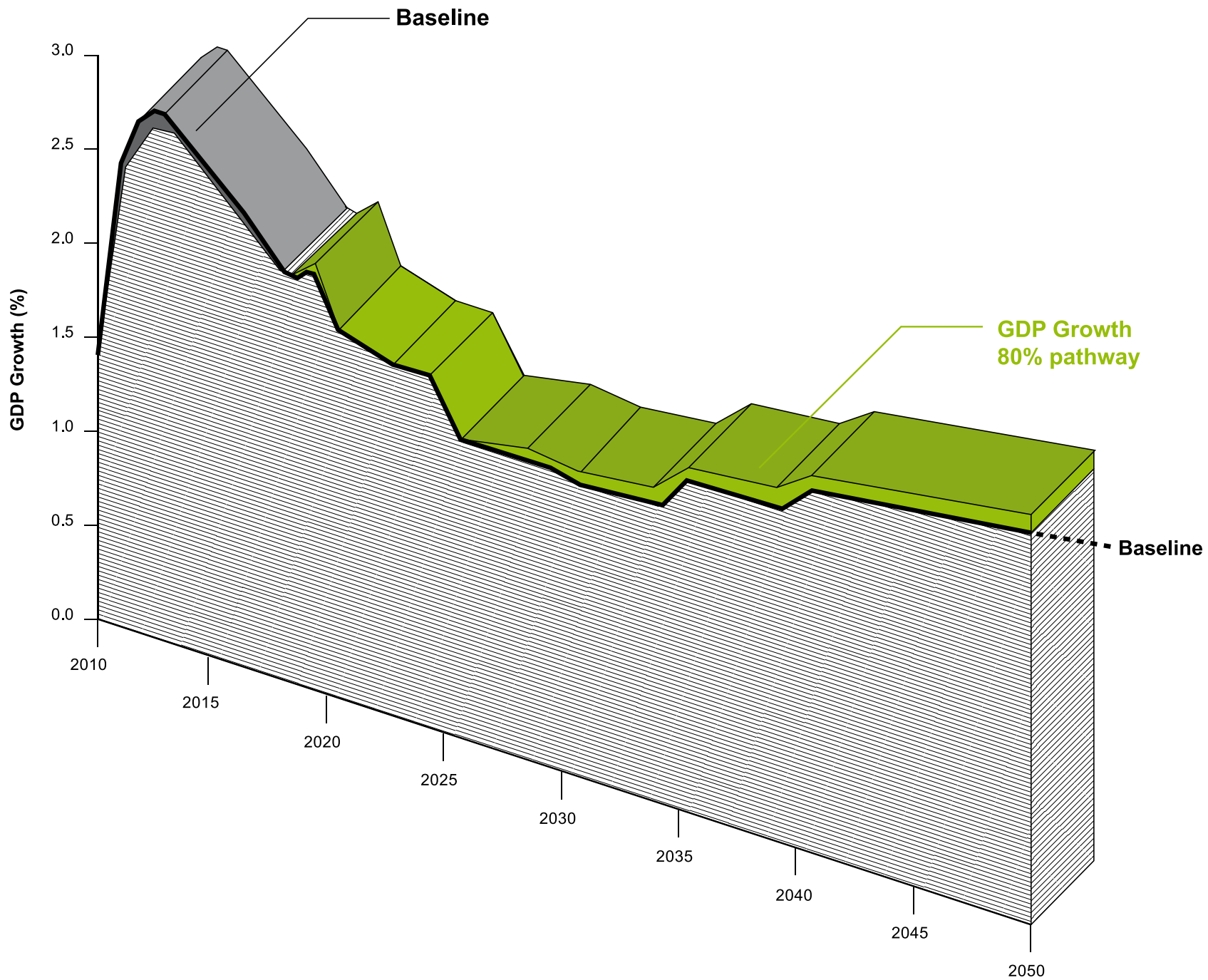
A doubling of capital spend would be required over the next 15 years  
SOURCE: Roadmap 2050 Technical Analysis

# LONG-TERM EU27 GDP



SOURCE: Roadmap 2050 Technical Analysis

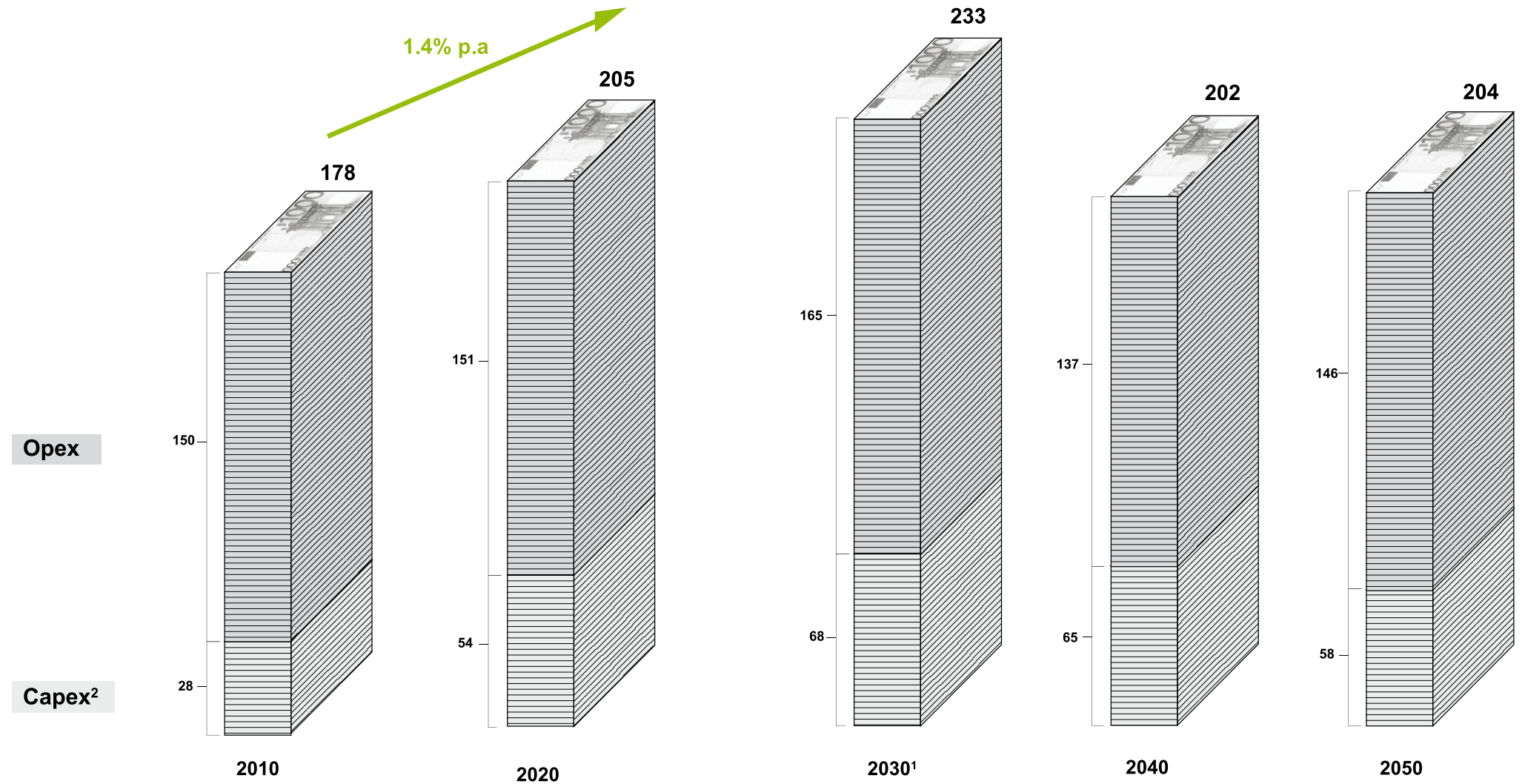
# EU27 GDP GROWTH RATE



SOURCE: Roadmap 2050 Technical Analysis

# POWER COSTS WILL PEAK IN 2030

FOR THE 60%  
PATHWAY, THE TOTAL  
POWER COSTS PEAK  
IN 2030 DUE TO  
INCREASING FUEL  
PRICES AND CAPITAL  
INVESTMENTS  
(€ BILLION PER YEAR)

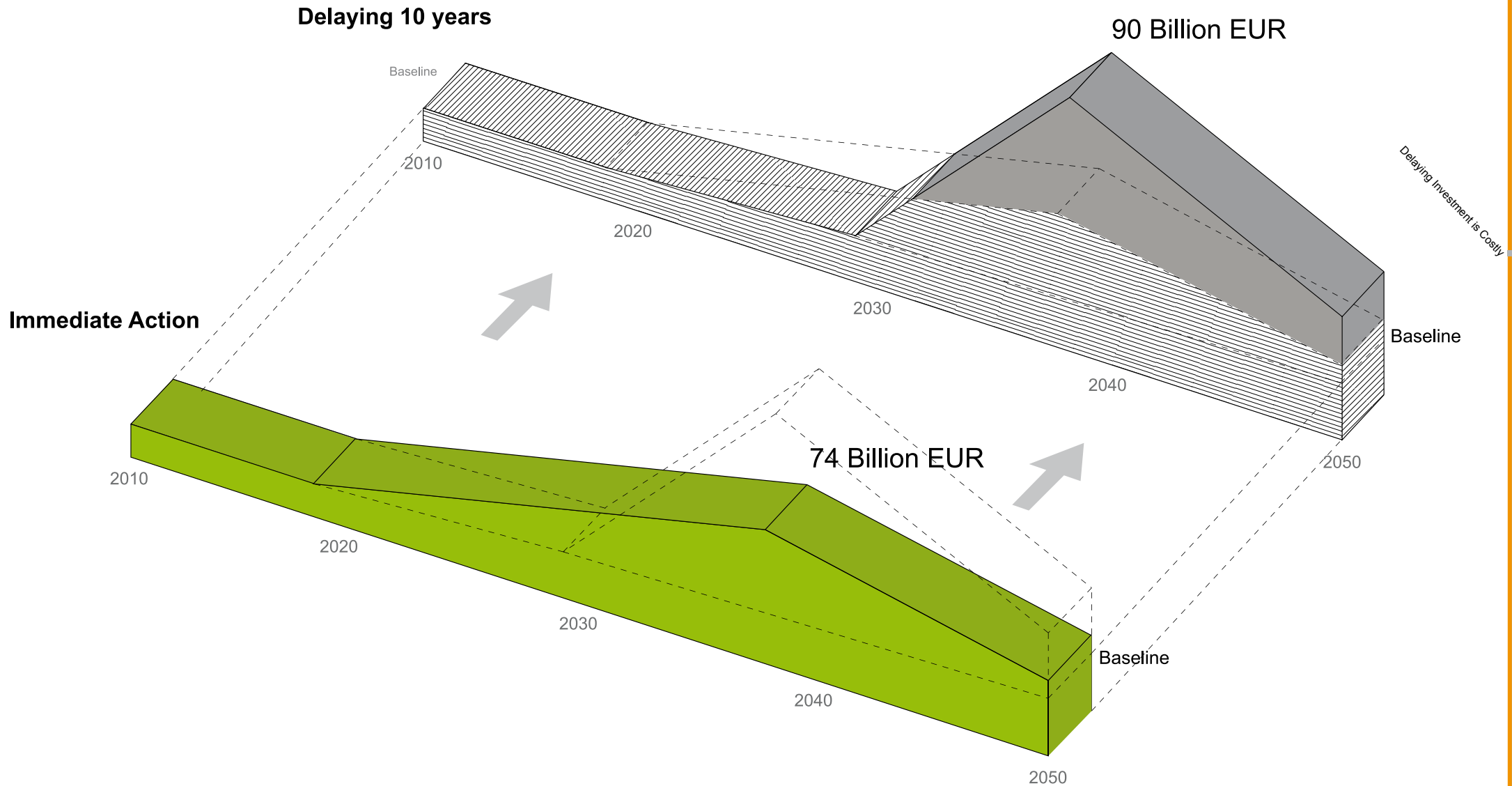


1) Around 2030, a relatively large share of the inefficient existing fleet is retired and replaced by new technologies, resulting in lower costs thereafter  
2) Including capex for grid and back up capacity  
SOURCE: Roadmap 2050 Technical Analysis

Cost Peak

# DELAYING ACTION INCREASES COSTS

ALTHOUGH INVESTMENT IS INITIALLY HIGH, THE ANNUAL COST OF DELAYING INVESTMENT IS MUCH HIGHER.

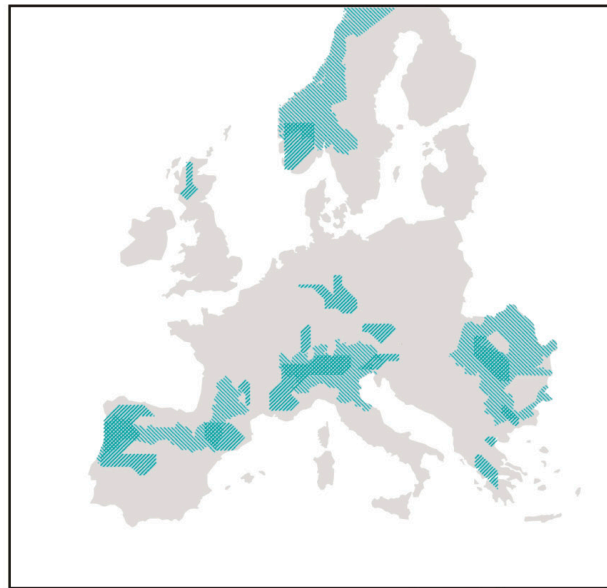


SOURCE: Roadmap 2050 Technical Analysis

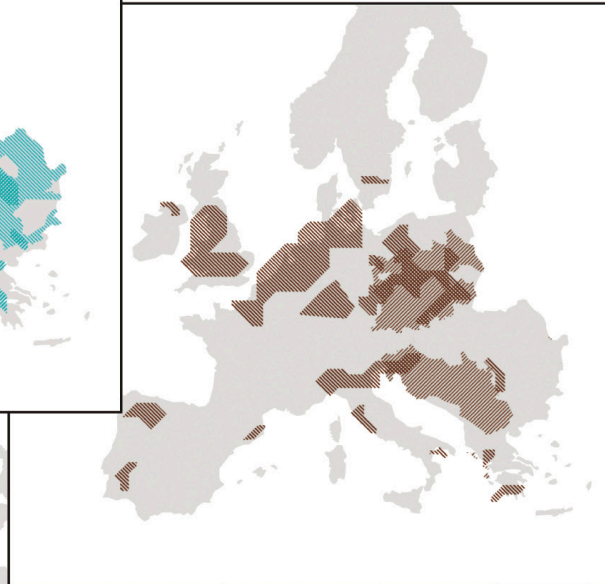


# RENEWABLE ENERGY RESOURCE MAPPING

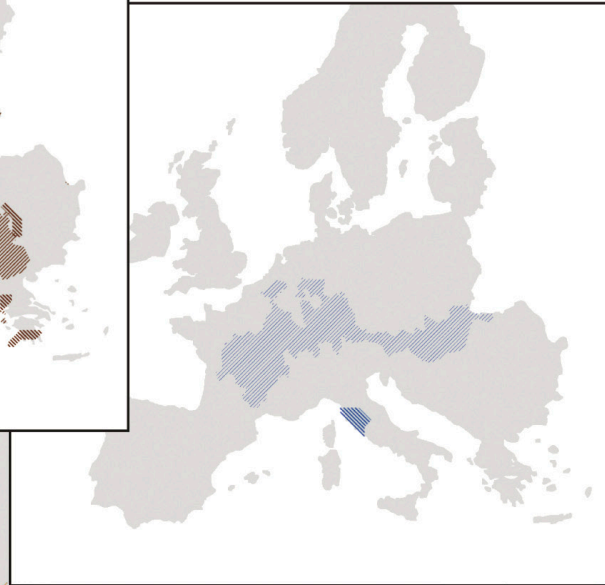
AN INTEGRATED EUROPE OFFERS A VARIETY OF GEOGRAPHIC PREDISPOSITION, AND THEREFORE A DIVERSE AREA OF HIGH POTENTIAL FOR REDRWABLE SOURCES.



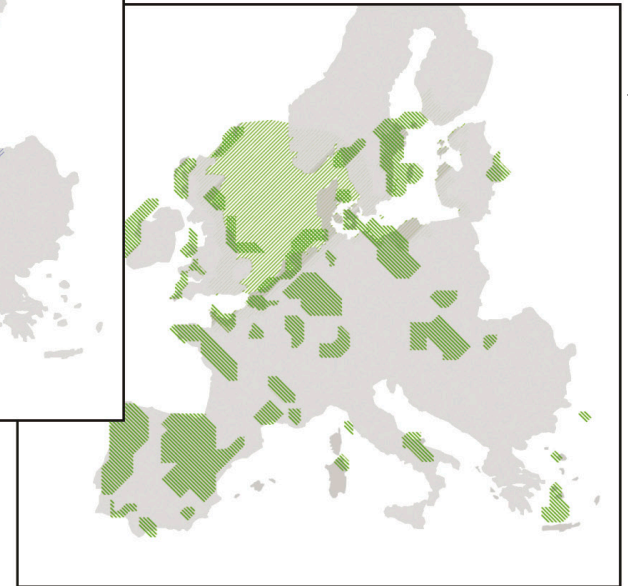
**HYDROPOWER**



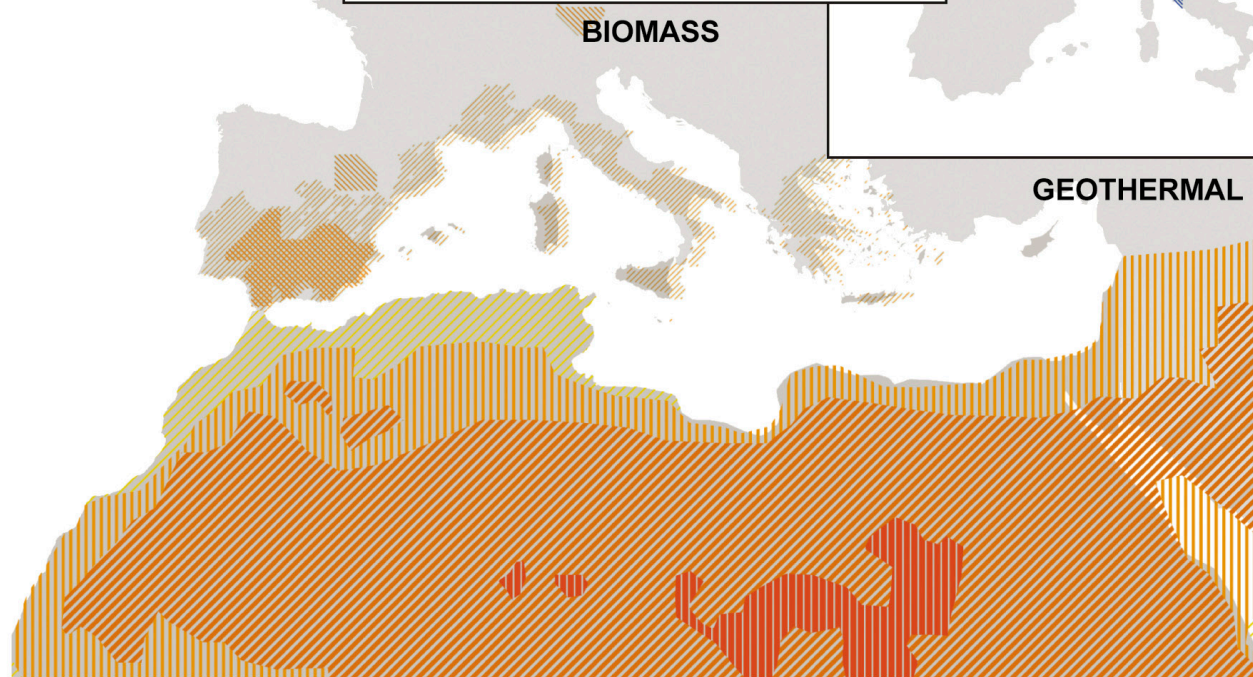
**BIOMASS**



**GEO THERMAL**



**WIND ENERGY**



**SOLAR**

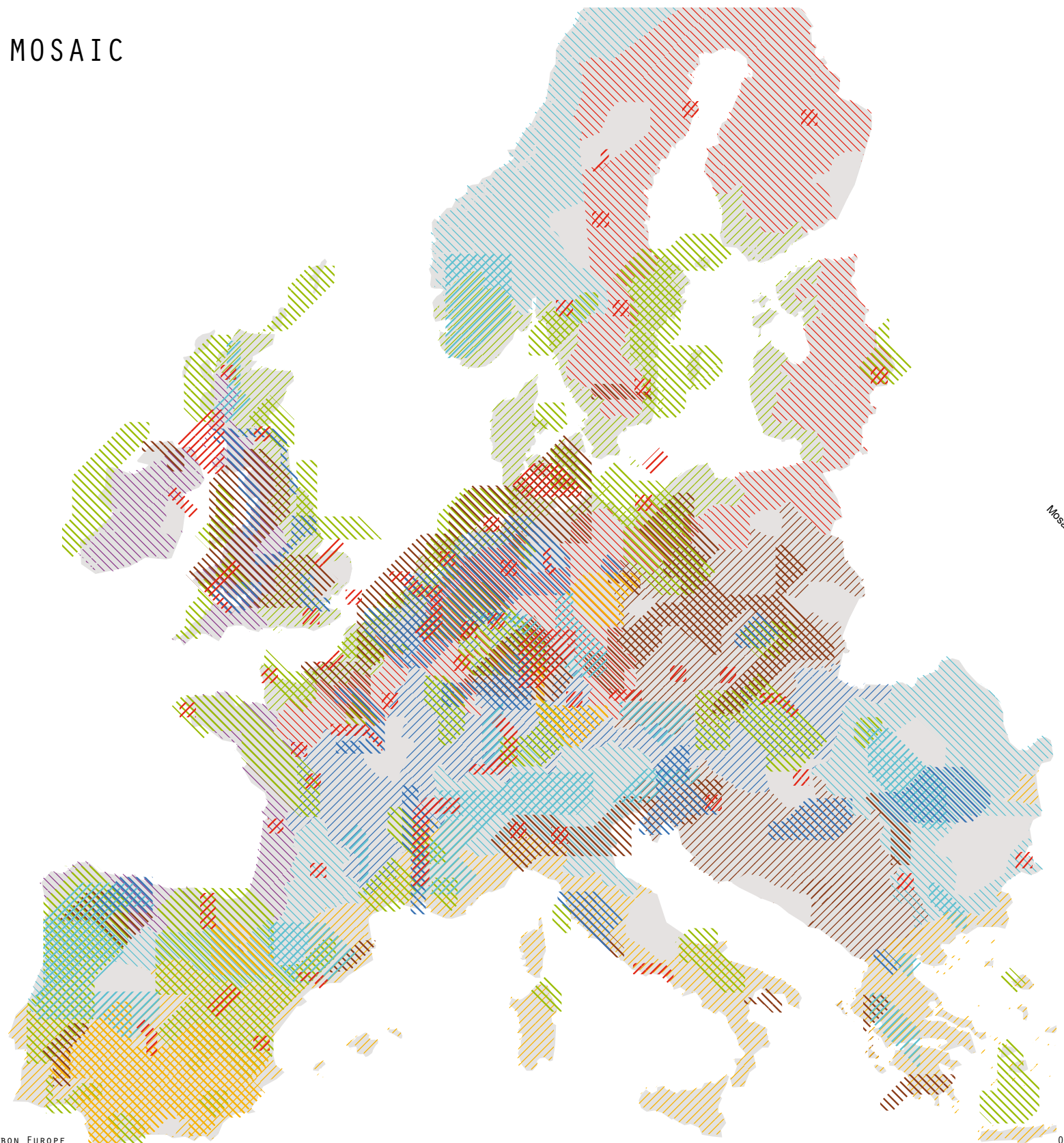
Forms of RES

Europe offers  
SOURCE: Roadmap 2050 Technical Analysis

# EU ENERGY RESOURCE MOSAIC

OVERLAY OF CURRENT ENERGY USE AND THOSE REGIONS WITH THE HIGHEST ENERGY POTENTIAL.

- Energy types**
- Geothermal existing
  - Geothermal potential
  - Hydropower existing
  - Hydropower potential
  - Wind existing
  - Wind potential
  - Solar existing
  - Solar potential
  - Tidal potential
  - CCS / Biomass existing
  - CCS / Biomass potential
  - Nuclear existing
  - Nuclear potential

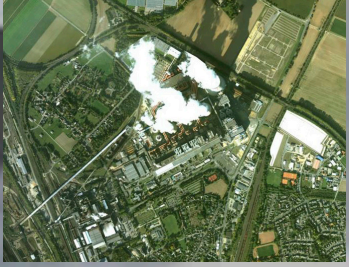


Mosaic RES Mapping



Eneropa

# BERGHEIM NOW



Location: Bergheim, Germany



Bergheim Now

Photo taken by: Ralph Orlovski/Getty Images  
Location: Bergheim, Germany  
Article in New York Times:  
<http://www.nytimes.com/2008/04/23/world/europe/23coal.html>

BERGHEIM IN ENEROPA



Bergheim Future

SOLARIA



Solaria

OMA/AMO

# ISLES OF WIND



Isles of Wind



# TIDAL STATES



Tidal States





# BIOMASSBURG



Biomassburg

# VRANIA



Vranja



Hydropia

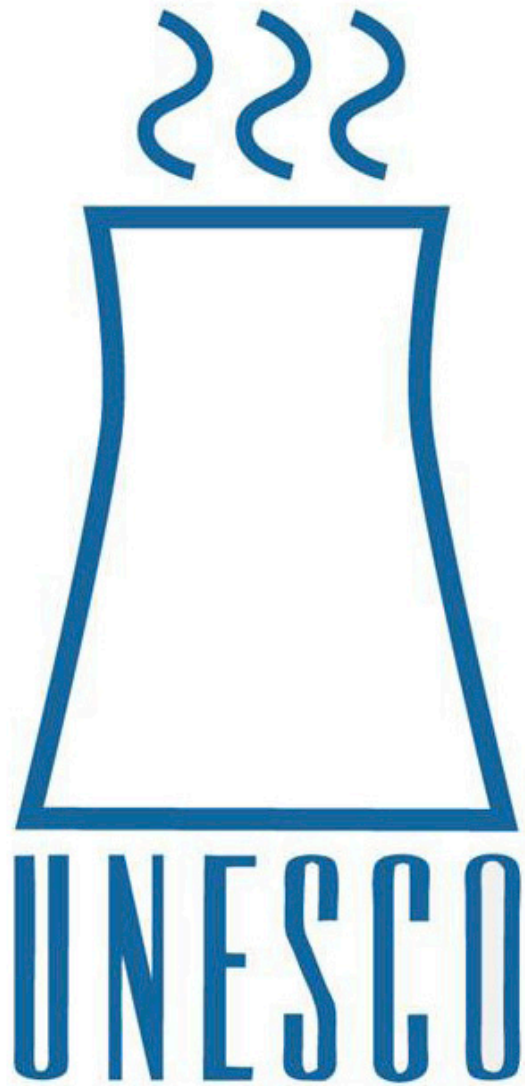
# ENHANCED GEOTHERMALIA



Geothermalia

# PRESERVED INFRASTRUCTURE

COAL BURNING POWER PLANTS ARE STILL PLANNED AND EVEN BEING BUILT AS PROPOSED ENERGY SOURCES. AS THE DEPENDENCE SWITCHES TO RENEWABLES, SOME PLANTS HAVE THE POTENTIAL TO BECOME UNESCO WORLD HERITAGE SITES BEFORE THEY ARE EVER COMMISSIONED.



Preserved Infrastructure

TRANSCRIPTS\_\_

VISIONARY DISCUSSION  
ROTTERDAM, NL  
15 FEBRUARY 2010

## TIM ABRAHAMS

UK DEPARTMENT OF ENERGY AND CLIMATE CHANGE

## LAURA BAIRD

OFFICE FOR METROPOLITAN ARCHITECTURE  
LAURA GRADUATED FROM DUKE UNIVERSITY AND RICE UNIVERSITY WITH DEGREES IN PUBLIC POLICY AND ARCHITECTURE RESPECTIVELY. SHE HAS BEEN WORKING WITH OMA SINCE 2007, WITH EXPERIENCE IN ENERGY EFFICIENT DESIGN AND ENERGY CONSERVATION, URBAN RESEARCH AND MASTER PLANNING. SHE IS CURRENTLY THE PROJECT LEADER FOR AMO'S WORK ADDRESSING ENERGY POLICY AND RENEWABLE ENERGY PLANNING.

## PETER BAKKER

CEO TNT

## LUC BAS

HEAD OF GOVERNMENT RELATIONS EUROPE THE CLIMATE GROUP  
AS HEAD OF GOVERNMENT RELATIONS LUC HAS ESTABLISHED THE CLIMATE GROUP'S FIRST PERMANENT PRESENCE IN BRUSSELS. LUC HAS SUCCESSFULLY RECRUITED SOME OF THE MOST SIGNIFICANT EUROPEAN REGIONAL GOVERNMENTS LEADING ON CLIMATE CHANGE TO THE CLIMATE GROUP'S STATES AND REGIONS COALITION. LUC IS INVOLVED IN DIFFERENT WORKING GROUPS AND INITIATIVES TO ENCOURAGE MORE AMBITIOUS EU-CLIMATE POLICY.

## MENNO VAN DIJK

SENIOR PARTNER MCKINSEY & COMPANY  
MENNO VAN DIJK JOINED MCKINSEY IN 1988 AND HAS BEEN BASED VARIOUSLY IN THE NETHERLANDS, AUSTRALIA AND SOUTH AFRICA. HE HAS LED PROJECTS IN INDIA, MOST EUROPEAN COUNTRIES AND THE USA AND IS CURRENTLY THE LEADER OF MCKINSEY'S EUROPEAN MEDIA PRACTICE. HIS WORK FOCUSES MAINLY ON BUSINESS UNIT STRATEGY, GROWTH AND MARKETING AND HAS CONCERNED NEWSPAPERS, CONSUMER AND BUSINESS MAGAZINES, PROFESSIONAL PUBLICATIONS, DIRECTORIES, BROADCASTING AND ONLINE PORTALS. HE HAS AN MSc IN PHYSICS FROM LEIDEN UNIVERSITY AND AN MBA FROM INSEAD, FRANCE.

## REINIER DE GRAAF

PARTNER OFFICE FOR METROPOLITAN ARCHITECTURE  
REINIER DE GRAAF JOINED OMA IN 1996 AS PROJECT DIRECTOR FOR DE ROTTERDAM. IN 2002 HE BECAME A DIRECTOR FOR AMO, THE THINK TANK OF OMA, AND WAS RESPONSIBLE FOR THE PRODUCTION OF 'THE IMAGE OF EUROPE', AN EXHIBITION THAT PROVIDES A HISTORY OF EUROPEAN POLITICAL REPRESENTATION. AMONG HIS DIVERSE INVOLVEMENT, RECENTLY HE HAS TAKEN RESPONSIBILITY FOR AMO'S GROWING PARTICIPATION IN RENEWABLE ENERGY PLANNING.

## MICHAEL HOGAN

EUROPEAN CLIMATE FOUNDATION  
MICHAEL HOGAN STARTED HIS CAREER IN 1980 WITH GENERAL ELECTRIC IN THE MARKETING OF LARGE POWER SYSTEMS. AFTER GRADUATING FROM HARVARD BUSINESS SCHOOL'S MBA PROGRAM IN 1988, HE EMBARKED ON A CAREER IN THE PRIVATE SECTOR POWER AND GAS BUSINESSES. HE AND COLLEAGUES WERE BACKED BY ROYAL DUTCH/SHELL IN THE START-UP OF INTERGEN, AND HE SPENT THE NEXT SEVEN YEARS IN LONDON LEADING THE GROWTH OF INTERGEN'S EUROPE/AFRICA/MIDDLE EAST/SOUTH ASIA BUSINESS UNIT. AFTER OVERSEEING THE RESTRUCTURING OF INTERGEN'S NORTH AMERICAN BUSINESS UNIT IN 2001 AND 2002, HE LEFT CENTRICA/DIRECT ENERGY IN 2006 WITH THE INTENTION OF PLAYING A MUCH DIFFERENT ROLE IN ENERGY, AND AFTER EARNING A MASTER OF SCIENCE DEGREE IN SEPTEMBER 2008 IN URBAN STUDIES & PLANNING FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY WITH A CONCENTRATION IN SUSTAINABLE ENERGY POLICY, HE JOINED ECF IN HIS CURRENT ROLE. IN ADDITION TO HIS MASTERS' DEGREES FROM HARVARD AND MIT, MICHAEL HOLDS A B.A. IN PHILOSOPHY AND A B.S. IN AEROSPACE ENGINEERING FROM THE UNIVERSITY OF NOTRE DAME.

## REM KOOLHAAS

OFFICE FOR METROPOLITAN ARCHITECTURE  
KOOLHAAS GRADUATED FROM THE ARCHITECTURAL ASSOCIATION IN LONDON, AND FOUNDED THE OFFICE FOR METROPOLITAN ARCHITECTURE IN 1975. IN 1978 HE PUBLISHED DELIRIOUS NEW YORK: A RETROACTIVE MANIFESTO FOR MANHATTAN. HE HEADS THE WORK OF BOTH OMA AND AMO, THE CONCEPTUAL BRANCH OF OMA FOCUSED ON SOCIAL, ECONOMIC AND TECHNOLOGICAL DEVELOPMENTS AND EXPLORING TERRITORIES BEYOND ARCHITECTURAL AND URBAN CONCERNS. HE IS A PROFESSOR AT HARVARD UNIVERSITY WHERE HE CONDUCTS THE PROJECT ON THE CITY.

## KEES VAN DER LEUN

Ecofys

## RUUD LUBBERS

FORMER PRIMINISTER NETHERLANDS  
LUBBERS IS A DUTCH POLITICIAN OF THE CHRISTIAN DEMOCRATIC APPEAL PARTY, WHO SERVED AS PRIME MINISTER OF THE NETHERLANDS FROM NOVEMBER 4, 1982 UNTIL AUGUST 22, 1994. IN THE FOLLOW-UP OF THE EARTH SUMMIT IN 1992, LUBBERS ENGAGED WITH THE EARTH CHARTER INITIATIVE IN COOPERATION WITH MICHAEL GORBACHOV AND MAURICE STRONG. THE EARTH CHARTER DOCUMENT WAS LAUNCHED IN THE PEACE PALACE IN THE HAGUE IN JUNE 2000. LUBBERS IS AN ACTIVE MEMBER OF THE INTERNATIONAL EARTH CHARTER COMMISSION AND REACHES OUT, ESPECIALLY TO YOUTH IN THE NETHERLAND, WITH THE MESSAGE OF THE EARTH CHARTER FOR A SUSTAINABLE AND PEACEFUL WORLD. AT THE END OF THE YEAR 2000, LUBBERS WAS APPOINTED BY THE SECRETARY-GENERAL OF THE UNITED NATIONS, MR. KOFI ANNAN, TO SUCCEED MRS. SADAKO OGATA AS UN HIGH COMMISSIONER FOR REFUGEES (UNHCR).

## EDUARDO DE MULDER

EXECUTIVE DIRECTOR, INTERNATIONAL YEAR OF PLANET EARTH SECRETARIAT, NGU, TRONDHEIM, NORWAY.  
EDUARDO DE MULDER LAUNCHED THE INITIATIVE TO PROCLAIM AN INTERNATIONAL YEAR OF PLANET EARTH (IYPE) BY THE UNITED NATIONS. AFTER COMPLETION OF HIS TERM AS IUGS PRESIDENT IN 2004, HE CHAIRED THE IYPE MANAGEMENT TEAM UNTIL HE WAS APPOINTED EXECUTIVE DIRECTOR OF THE IYPE SECRETARIAT.

## KALYPSO NICOLAIDIS

PROFESSOR OF INTERNATIONAL RELATIONS AND DIRECTOR OF THE EUROPEAN STUDIES CENTRE, UNIVERSITY OF OXFORD.  
KALYPSO NICOLAIDIS IS UNIVERSITY LECTURER IN INTERNATIONAL RELATIONS AT THE UNIVERSITY OF OXFORD, A FELLOW AT ST ANTONY'S COLLEGE WHERE SHE TEACHES IN INTERNATIONAL RELATIONS AND A MEMBER OF THE FACULTY OF THE WORLD TRADE INSTITUTE, BERN, SWITZERLAND. PREVIOUSLY SHE WAS ASSOCIATE PROFESSOR AT HARVARD UNIVERSITY'S KENNEDY SCHOOL OF GOVERNMENT WHERE SHE SERVED AS THE FACULTY CHAIR FOR THE SOCRATES KOKKALIS PROGRAM ON SOUTHEASTERN EUROPE. SHE ALSO TAUGHT AT THE ECOLE NATIONALE D'ADMINISTRATION IN PARIS. IN HER RESEARCH, SHE COMBINES LONG-STANDING INTERESTS IN EXPLORING THE SOURCES AND FORMS OF CO-OPERATION IN REGIONAL AND MULTILATERAL SETTINGS AND THE DYNAMICS OF EUROPEAN INTEGRATION. SHE HAS PUBLISHED ON INSTITUTIONAL, POLITICAL AND ECONOMIC DEVELOPMENTS IN THE EUROPEAN UNION, ENLARGEMENT EASTERN AND CENTRAL EUROPE, INTERNATIONAL TRADE, THE WTO, CONFLICT RESOLUTION AND NEGOTIATION THEORY. SHE IS THE CO-EDITOR OF THE GREEK PARADOX: PROMISE VS PERFORMANCE (MIT PRESS, 1997), TRANSLATED IN GREEK AND TURKISH, AND STRATEGIC TRENDS IN SERVICES: AN ENQUIRY INTO THE WORLD SERVICES ECONOMY (HARPER AND ROW, 1989). HER UPCOMING BOOK IS ENTITLED MUTUAL RECOGNITION AMONG NATIONS: GLOBAL LESSONS FROM THE EUROPEAN EXPERIENCE. HER LAST PUBLICATION, THE FEDERAL VISION: LEGITIMACY AND LEVELS OF GOVERNANCE IN THE UNITED STATES AND THE EUROPEAN UNION IS PART OF A BROADER PROJECT CONDUCTED AT THE CENTER FOR EUROPEAN STUDIES AT OXFORD ON THE FUTURE OF EUROPE AND THE 2004 AGENDA AND IS CURRENTLY ADVISING THE GREEK FOREIGN MINISTRY ON THESE ISSUES. SHE HAS LONG BEEN INVOLVED IN ACTION-RESEARCH ON GREECE'S RELATIONS WITH THE BALKANS AND TURKEY.  
NICOLAIDIS HOLDS A PHD IN POLITICAL ECONOMY AND GOVERNMENT FROM HARVARD UNIVERSITY, A MASTER IN PUBLIC ADMINISTRATION FROM THE KENNEDY SCHOOL OF GOVERNMENT, A MASTER IN INTERNATIONAL ECONOMICS AND A DIPLOME FROM THE INSTITUT D'ETUDES POLITIQUES IN PARIS.

## COEN VAN OOSTROM

CEO OVG REAL ESTATE  
COEN GRADUATED FROM BUSINESS ECONOMICS AT THE ERASMUS UNIVERSITY, ROTTERDAM IN 1995. IN 1997 COEN FOUNDED HIS OWN REAL ESTATE DEVELOPMENT COMPANY OVG WHICH IS CURRENTLY THE LARGEST COMMERCIAL DEVELOPER IN THE NETHERLANDS. THE ORGANIZATION'S SUCCESSFUL AND INVENTIVE TAKE ON THE DEVELOPMENT PROCESS RECEIVED CRITICAL ACCLAIM, CULMINATING IN BEING AWARDED THE PRESTIGIOUS FD PROPERTYNL AWARD (2006) FOR BEST DEVELOPER. IN 2007, COEN WAS INDIVIDUALLY HONORED WITH THE 'REAL ESTATE PERSONALITY OF THE YEAR' AWARD; FURTHER TESTAMENT TO THE STRENGTH OF THE UNIQUE APPROACH; CUSTOMERS INSTEAD OF LOCATION AND "GREEN" BUILDING.

## MICHEL RUIS

MINISTRY OF TRANSPORT, PUBLIC WORKS AND WATER MANAGEMENT

## JURRIAN RUYS

PARTNER MCKINSEY & COMPANY  
EDUCATION: DELFT UNIVERSITY OF TECHNOLOGY, MA CHEMICAL ENGINEERING, SEPTEMBER 1985 – FEBRUARY 1992

## ROBERT SEEGERS

PUBLIC AFFAIRS AND COMMUNICATIONS COCA COLA ENTERPRISES

## HARTMUT MAYER

OXFORD UNIVERSITY, ASSITENT TO KALYPSO NICOLAIDIS IN THE EU REFLECTION GROUP.

## HEIDE SCHUSTER

COO WERNER SOBER GREEN TECHNOLOGIES  
DR.-ING. MA HEIDE SCHUSTER  
1969 BORN IN INGOLSTADT/GERMANY 1989 – 1990, STUDIED FRENCH LANGUAGE AT THE UNIVERSITY OF TOULOUSE/FRANCE, 1990 – 1997 STUDIED ARCHITECTURE AT THE UNIVERSITY OF APPLIED SCIENCES, DARMSTADT 1997 – 1998 ENVIRONMENT & ENERGY STUDIES MASTERS PROGRAMME, ARCHITECTURAL ASSOCIATION LONDON, 1998 – 2000 ARCHITECT AND ENVIRONMENTAL CONSULTANT, 2000 – 2006 LECTURER AND RESEARCHER AT THE UNIVERSITY OF DORTMUND, 2006 PHD IN ARCHITECTURE / LIGHTING TECHNOLOGY / PERCEPTION, 2007 INITIATOR AND FOUNDING MEMBER OF THE GERMAN SUSTAINABLE BUILDING COUNCIL (GESBC), SINCE 2007 MANAGING PRINCIPAL OF WSGREENTECHNOLOGIES, STUTTGART, 2008 AUDITOR OF THE GERMAN SUSTAINABLE BUILDING COUNCIL IMPORTANT PROJECTS INCLUDE: DUBAI CRYSTAL, DUBAI/UAE SKY GARDENS DUBAI/UAE EXHIBITION CENTRE ST. PETERSBURG/RUSSIA LEED + GESBC CERTIFICATION. PROJECTS COMPETITION KAUFHOF DUISBURG. COMPETITION LIBRARY OSLO/NORWAY

JR: AFTER THESE PRESENTATIONS I WOULD SAY "THE NEXT HOUR IS OVER TO YOU".

AS YOU CAN SEE, WE HAD SOME SUCCESSES, BUT WE ALSO HAD SOME REAL CONCERNS AND FRUSTRATIONS. WE HAVE BEEN CHALLENGED VERY EFFECTIVELY. SO OUR QUESTION IS: HOW IS THIS POSSIBLE? TECHNICALLY, I UNDERSTAND IT, OF COURSE YOU CAN BELIEVE WHICHEVER YOU WANT TO BELIEVE, BUT I CAN SEE THAT IT'S NOT IMPOSSIBLE. THE QUESTION IS: HOW ARE WE GOING TO ORGANIZE THIS PRACTICALLY?

WE WOULD LIKE TO SPLIT THE DISCUSSION IN TWO PARTS OF 30 MINUTES EACH. IN THE FIRST PART I WOULD LIKE TO SPEND TIME WITH SOME OF THE REFLECTIONS FROM YOUR SIDE. ONE: WHAT DO YOU LIKE ABOUT THIS STORY? WHY DO YOU THINK THIS STORY IS AN IMPORTANT STORY THAT IS CONSISTENT WITH WHAT IS HAPPENING TODAY IN THE SOCIETY? HOW CAN IT BUILD ON CURRENT DYNAMICS IN SOCIETY? WHAT IS THE RELEVANCE OF THIS? IS IT JUST AN ENERGY POLICY OR COULD IT BE MORE FOR EUROPE? SO HELP US TO COLLECT THE ARGUMENTS ON WHY THIS IS REALLY IMPORTANT. ALSO GIVE US YOUR VIEW OF THE CHALLENGES THAT WE FACE. WHAT IS CRITICAL TO GET IT RIGHT AND WHAT IS GOING TO BE REALLY THOUGH IF YOU HEAR THIS STORY? THEN IN THE SECOND PART WE WILL THINK ABOUT SOLUTIONS HOW WE CAN RESOLVE THIS. MAYBE FIRST I'LL JUST OPEN THE FLOOR TO YOU. CAN YOU GIVE ME YOUR VIEWS ON WHY IT IS IMPORTANT AND WHERE YOU SEE THE ISSUES AND THE CHALLENGES?

WHO WOULD LIKE TO START?

P. BAKKER: I'LL VOLUNTEER.

I AM IMPRESSED WITH THE STORY, ACTUALLY THE COMBINATION OF THE TWO STORIES. I FIND IT QUITE POWERFUL. WE CAN ALL SIT BACK AFTER COPENHAGEN BEING FRUSTRATED BY THE LACK OF POLITICAL SUCCESS AND WITH THE SHAMING OF THE IPCC (INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE) REPORT AS IT IS NOW, BUT THE CASE WILL ONLY GET WORSE. WHAT YOU HAVE PRESENTED HERE IS QUITE A POWERFUL SET OF EVIDENCES THAT WITH CURRENT TECHNOLOGY IT'S POSSIBLE TO ACHIEVE THE GOAL OF DECARBONIZING THE POWER SECTOR, AND THERE'S EVEN A BEGINNING OF A BUSINESS CASE, IF I READ YOUR CHARTS WELL. I THINK WE DESPERATELY NEED TO GET THAT MESSAGE OUT, RATHER THAN ANOTHER MOVIE ON WHY THE WORLD WOULD COME TO AN END, WE NEED A MOVIE THAT SHOWS HOW WE ARE GOING TO SOLVE THIS, IF WE WERE ABLE TO PUT THAT TOGETHER. I THINK THAT POWER GENERATION IS AT THE CORE OF THAT. THEN, THE WHOLE PERSPECTIVE AROUND THE CLIMATE DEBATE IS LIKELY TO SHIFT. I THINK I SEE REAL STRENGTHS IN YOUR STORY TO GET THERE.

H. MAYER: I FIND THESE TWO STORIES VERY, VERY POWERFUL. TO RELATE THEM TO TWO ASPECTS: THE STORY IN THE FILM IS THAT WE MAKE THIS PROGRESS, BUT WE NEVER SAID WHO PAYS THE PRICE AND WHAT IT MEANS IN THE EUROPEAN CONTEXT. IF YOU WANT TO HAVE ENERGY CLIMATE CHANGE DEBATE, YOU WANT TO LINK IT TO THE OTHER TWO STORIES TO UNDERSTAND WHO PAYS THE PRICE DOMESTICALLY AND WHAT KIND OF DOMESTIC CHANGES COME WITH THESE INDUSTRIAL CHANGES.

AND WHAT GLOBAL CONTEXT DO WE HAVE? IF YOU SAY 'INDUSTRIAL

WITH CURRENT  
TECHNOLOGY  
IT'S POSSIBLE  
TO ACHIEVE  
THE GOAL OF  
DECARBONIZING  
THE POWER  
SECTOR.

THE STORY HOWEVER, I FIND IT FASCINATING AND POWERFUL, BUT IF IT'S NOT COMBINED WITH THE OTHER STORIES. LIKE: WHO PAYS THE DOMESTIC PRICE, WHAT DOES IT ACTUALLY MEAN POLITICALLY? WHAT DOES IT MEAN FOR THE EVERYDAY LIFE? THAT IS THE FUNDAMENTAL DIFFERENCE BETWEEN THE MOON-LANDING EXAMPLE. WE ALL PAY AND SEND ONE MAN TO THE MOON. ONLY HERE YOU HAVE EVERY MAN INVOLVED WHICH IS A TOTALLY DIFFERENT STORY. I FIND THIS INTERESTING, BUT I WOULDN'T TRY TO LINK IT TO THE TWO OTHER NARRATIVES.

L. BAS: I WAS ALSO VERY IMPRESSED WITH SOME OF THE COMPARISONS THAT YOU MADE. WE KNOW MOST OF THEM, SO IT WAS NICE TO SEE THEM ALL CORRELATED TOGETHER HERE. I HAVE ALSO A FEW QUESTIONS AND IT RELATES TO PATHWAYS TO SUCH AS ZERO CARBON SOCIETY IN 2050, IT'S ON THE ENERGY EFFICIENCY SIDE OF THINGS.

OBVIOUSLY, IT NEEDS A BIG FOCUS AND INCREDIBLE INVESTMENTS THAT HAVE TO HAPPEN IN THE POWER SECTOR. THAT'S WHERE THE BIG MONEY IS, SO TO SAY, WILL HAVE TO PLAY AND HUGE INVESTMENTS ARE NECESSARY. THIS TECHNICAL QUESTION WE CAN DEAL WITH A LITTLE BIT LATER, BUT IT SEEMS LIKE THE ASSUMPTIONS FOR THE EFFICIENCY POTENTIAL ARE NOT VERY CLEAR HERE, MAYBE THEY'RE BETTER EXPLAINED IN THE REPORT. I THINK IT'S VERY IMPORTANT TO BE VERY CLEAR WHAT YOUR ASSUMPTIONS WERE FOR ENERGY EFFICIENCY GAINS AND WHICH WERE THE ACTUALLY SAVINGS, NOT EFFICIENCY. IT SEEMS TO BE UNDERESTIMATED HERE, TOO MUCH FOCUS ON ONLY THE POWER SIDE OR ON THE SUPPLY SIDE. SO THAT'S A GENERAL REMARK. I THINK THIS HAS TO BE PLACED INTO THE WHOLE SOCIETY DISCUSSION REGARDING ENERGY SAVING AND ENERGY EFFICIENCY POTENTIAL. THAT, I BELIEVE, IS BIGGER.

THAT SAID: THERE IS A CERTAIN CLIMATE FATIGUE AFTER COPENHAGEN. THAT'S HOW WE STARTED TO CALL IT. UNFORTUNATELY, OUR ORGANIZATION IS CALLED THE CLIMATE GROUP.

H. MAYER: GET A REBRANDING.

(LAUGHTER)

L. BAS: WE WILL BE ON A FOREFRONT TO ALWAYS FIGHT FOR THE CAUSE AND WE ALL KNOW THAT THE BACKGROUND FOR ALL OF THIS, IS AVOIDING CLIMATE CHANGE. IT DOESN'T RUN SO VERY WELL ANY MORE WITH THE DECISION MAKERS, YOU CAN ALL TELL NOW. I DON'T SEE ANY IMPROVEMENTS IMMEDIATELY.

REVOLUTION', WHAT DOES IT MEAN FOR THE SOCIAL COMPOSITION? WHAT DOES IT MEAN FOR THOSE WHO WORK IN THOSE AREAS, AND WHAT DOES IT MEAN FOR COLONIALISM, AND SO ON? IF YOU HAVE A EUROCENTRIC DEBATE ON THESE ISSUES AND THE MESSAGE IS UNDERSTOOD, IT'S VERY POWERFUL FOR THE EUROPEANS. I AM NOT SURE WHETHER COPENHAGEN FAILED BECAUSE EUROPEANS DID NOT UNDERSTAND IT OR BECAUSE THEY WERE NOT HEARD AND BECAUSE OTHER PEOPLE HAD OTHER CONCERNS. THEREFORE ONE HAS TO LOOK AT THE DIFFERENT AUDIENCES FOR THE STORY.



SO THIS WHOLE STORY IS ABOUT THE ECONOMIC OPPORTUNITIES AS A MOTIVATOR FOR ADDRESSING CLIMATE CHANGE. THIS IS A VERY GENERAL REMARK AND AS IT HASN'T BEEN SAID BEFORE, I AM HAPPY TO BE THE FIRST TO DO SO.

AND SECONDLY, IT'S NOT ONLY AN OPPORTUNITY, BUT IT'S ALSO A BIG RISK NOW FOR THE EUROPEAN ECONOMY, JUST LOOK AT WHAT IS HAPPENING IN CHINA (I WILL NOT GO INTO DETAIL). IF WE LOSE THAT PART OF OUR KNOWLEDGE BASED ECONOMIC ADVANTAGE AND IF WE DON'T GET THE EU 2020 STRATEGY PROPERLY FOCUSED ON ENERGY EFFICIENCY AND RENEWABLE ENERGY, WE ARE NOT ONLY GOING TO LOSE THE CLASSIC INDUSTRY (OF COURSE NOBODY'S THERE TO TELL, BUT IT'S HAPPENING), WE'LL EVEN GET WORSE. I'M FROM BELGIUM AND I JUST SAW IT HAPPENING AGAIN IN ANTWERP, YOU COULD TELL 5 YEARS AGO THAT OPEL WOULD CLOSE. SO NOW WE HAVE TO DRASTICALLY REALIGN OR WE'LL ALSO LOSE ALL KIND OF ADVANTAGES.

### ECONOMIC OPPORTUNITY CAN BE A MOTIVATOR FOR ADDRESSING CLIMATE CHANGE.

CHINA, JUST AS YOU'VE READ, TOOK OVER THE LEAD ON THE WIND POWER. NOW IT'S OFFICIAL AND IT IS ONLY THE START. IT IS NOT ONLY THE OPPORTUNITIES; IT IS ALSO A BIT OF A DANGER THERE WHICH WE HAVE TO BE AWARE OF.

J. RUYS: I'LL TAKE UP ON YOUR REMARK. FOR ME PERSONALLY AND FOR EVERYBODY'S COMFORT, IT HAS BEEN INCLUDED; IT'S ALL THE EFFICIENCY WORK THAT IS INCLUDED IN THIS STORY. WE NEED IT, AND IF WE DON'T DO IT, WE DON'T HAVE ENOUGH ENERGY RESOURCES TO ACTUALLY BUILD ALL THIS RENEWABLE GENERATION CAPACITY.

L. BAS: ONE LAST THING, I DON'T WANT TO TAKE MUCH OF YOUR TIME, BUT THE LINK WITH NORTH AFRICA HAS TO BE CLEAR; EITHER IT'S INCLUDED OR IT'S NOT. TRANSMISSION GOES IN TWO DIRECTIONS, SOMETIMES IT ISN'T WHERE THE GRID IS. I SAW THE CONNECTIONS IN EUROPE FROM REGION TO REGION AND IT'S NOT INCLUDED, BUT IN SOME OTHER PARTS OF THE DISCUSSION YOU DO INCLUDE IT. I THINK IT MAKES AN INCREDIBLE DIFFERENCE, A BIG DIFFERENCE, ON YOUR 60% PATHWAY IF YOU INCLUDE CSP FROM NORTH AFRICA AS NOW IT'S VERY MARGINAL. IT'S PROBABLY ONE OF THE BIGGEST OPPORTUNITIES FOR THE REAL SOLUTION.

T. ABRAHAMS: I PRETTY MUCH AGREE WITH SOME OF THE THINGS BEING SAID. I THINK IN TERMS OF PRESENTING A STORY IT'S VERY IMPORTANT TO UNDERSTAND HOW IT'S GOING TO IMPACT THE INDIVIDUALS AND I SUPPOSE TWO THINGS STRUCK ME THERE.

ONE THING IS THAT EVEN THOUGH THE NUMBER OF WIND GENERATORS WILL BE LESS, THEY WERE GETTING BIGGER AND PLACED IN MORE DIFFICULT LOCATIONS. THIS RINGS BELLS, CERTAINLY IN GOVERNMENTS' MINDS, ABOUT PUBLIC ACCEPTABILITY.

ONE OF THE OTHER AREAS WHICH IS ALL ABOUT THIS SORT OF TRANSITION, IS PARTICULARLY ABOUT THE TRANSITION FROM FOSSIL FUELS; THE CONTINUING DEMAND OF FOSSIL FUELS OVER THE NEXT 40 YEARS AND HOW YOU ACTUALLY MANAGE THAT, HOW YOU GIVE THE PROVIDENCE OF FOSSIL FUELS THE RIGHT INCENTIVES TO KEEP EXPLORING AND BEING ABLE TO HAVE SOME SORT OF VISION OF WHAT THEY CAN EXPECT OVER THAT PERIOD.

I NOTICED ON ONE OF THE MAPS, I THINK IT WAS THE WEST COAST OF THE UK AND IT BECAME TIDAL LAND. TIDAL IS CLEARLY ONE OF THOSE TECHNOLOGIES, WHICH IS A LITTLE BIT FURTHER DOWN THE STREAM (IF YOU EXCUSE THE PUN). I WOULD BE INTERESTED TO SEE HOW FAR YOU FEEL THAT THAT'S AN IMPORTANT PART.

FINALLY, I AGREE THAT THE PARTICULARLY THE NORTH AFRICAN SOLAR, PERHAPS TO A SLIGHT LESSER EXTENT THAN ICELANDIC GEOTHERMAL, IS CLEARLY VERY DELIBERATELY INSULAR EU LOOK. NORTH AFRICAN SOLAR DOES RAISE A LOT OF ISSUES ALSO ABOUT DEPENDENCE AND GEOPOLITICS. I THINK IN YOUR VISION OF 2050, THERE'S GOT TO BE A POSSIBILITY OF

THOSE SIZES; FOR EXAMPLE, HOW MUCH SPACE YOU WOULD NEED TO BE ABLE TO PROVIDE RENEWABLE ENERGY ACROSS EUROPE. I THINK THAT'S A VERY GOOD DRIVER TO BE LOOKING AT IT.

**NORTH AFRICA  
DOES ALLOW YOU  
TO BE MORE  
AMBITIOUS.**

J. RUYS: MAYBE A VERY QUICK IMPLICATION

ON THE TIDAL AND THE NORTH AFRICA. IN THIS ANALYSIS WE WOULD NOT WANT TO CLAIM THAT IT IS NOT A GOOD IDEA. WHAT WE'VE DONE IS BUILT A CASE AS ROBUST AS POSSIBLE TO PROVE IT'S POSSIBLE. OF COURSE WE COULD ARGUE IF WE COULD DO IT WITHOUT TIDAL, IF WE COULD DO IT WITHOUT NORTH AFRICA; CLEARLY THAT'S A STRONGER MESSAGE. IF YOU WOULD INCLUDE NORTH AFRICA WE COULD BE ATTACKED WITH THE RATIONAL THAT SOME PEOPLE MIGHT NOT WANT TO INCLUDE NORTH AFRICAN, SO THEY THINK THAT IT'S NOT POSSIBLE. I THINK IT'S A WHOLE SEPARATE DISCUSSION, WE PROVE IT IS POSSIBLE WITH THE SIMPLE TOOLS THAT WE HAVE NOW AND WE APPRECIATE THAT THE FUTURE WILL BE DIFFERENT AND HOPEFULLY BETTER.

R. DE GRAAF: WITH A FOOTNOTE THERE, NORTH AFRICA DOES ALLOW YOU TO BE MORE AMBITIOUS AS A WHOLE, IN THE SENSE THAT IF YOU DO NOT WANT TO RELY ON BREAKTHROUGHS IN TECHNOLOGY, THE INCORPORATION OF NORTH AFRICA IS NEEDED FOR A 100% RENEWABLE SCENARIO. TO SOME EXTENT, IT IS POSSIBLE WITHOUT, BUT IT DOES ALLOW YOU TO BE MORE DETERMINED WHICH IS, OF COURSE, ON A GLOBAL HAS A LARGER IMPACT.

J. RUYS: MAYBE MORE OF THE CHALLENGES, WHAT IS WITHHOLDING US FROM DOING THIS?

**THERE IS A WIN-  
WIN BETWEEN  
ECOLOGY AND  
ECONOMY. STRESS  
THAT ALL THE  
TIME.**

R. LUBBERS: I THINK IT WAS A VERY GOOD PRESENTATION, WHICH MADE IT CLEAR THAT TECHNOLOGY IS NOT THE PROBLEM, THE MANY OPPORTUNITIES THAT ARE COMPLIMENTARY AND SO ON. I AM NOT GOING TO REPEAT THAT.

SECONDLY I FIND IT ACCEPTABLE TO FOCUS ON EUROPE. THE EUROPE CLIMATE FOUNDATION EVEN ADVISES TO PUT IT IN THE CENTER, WHICH THE EUROPEAN UNION HAS TO MAKE A

NEXT REMARK; YES, IT WILL GO BETTER AND FASTER IF YOU HAVE THE SUPPORT OF CITIZENS AND CIVIL SOCIETY, INSTITUTIONS, ETC. IT'S DOABLE TO EXPLAIN TO THE PUBLIC AT LARGE THAT THIS IS GOOD FOR THE ECONOMY AS WELL, THAT THERE IS A WIN-WIN BETWEEN ECOLOGY AND ECONOMY. STRESS THAT ALL THE TIME. GET PEOPLE TO PUSH INDUSTRIES TO GO FORWARD.

MY FOLLOWING REMARK; IN MY EXPERIENCE WE MADE A VERY INTELLIGENT CHOICE TO GO FOR THE EMISSION TRADING, AS AN INSTRUMENT, BUT LET US BE FAIR: TODAY IT IS VERY WEAK AND VULNERABLE. THIS MAY BE A KEY POINT. THE WORLD IS ORGANIZED WITH THIS 'THING' OF A LEVEL PLAYING FIELD AS THE MAIN TRACK TO ORGANIZATION; IT IS IN ALL THE SPEECHES. YET, AT THE SAME TIME, IT IS EXACTLY THE INSTRUMENT WHY WE GO VERY SLOWLY FORWARD. I THINK YOU CANNOT AVOID REFLECTING ON THIS. HOW DO WE REALIZE A CARBON FREE EUROPE? WILL THE INSTRUMENT OF THE EMISSION TRADING SYSTEM BE ESSENTIAL IN THAT, YES OR NO? CAN WE AFFORD TO DO IT ALONE? DO WE NEED OTHER INSTRUMENT? IT'S NOT A CRITICISM OF THE PRESENTATION, BUT IT IS THE KEY POINT I THINK.

THEN; I AM IN FAVOR TO START THIS EUROPEAN UNION CENTRIC, BUT OF COURSE YOU HAVE TO RELATE TO THE WORK TO GIVE A LIST OF (FOR ME) IMPORTANT DIMENSIONS, WHICH YOU SHOULD NOT AVOID.

FIRSTLY, 20 YEARS AGO WE AGREED THE EUROPEAN ENERGY CHARTER. I AM ABSOLUTELY CONVINCED IT'S POSSIBLE TODAY TO AGREE ON A EUROPEAN ZERO CO2 CHARTER TO FORGE A COALITION WITH THE RUSSIAN AND THE SISTER STATES THERE. THAT MIGHT BE INTERESTING AND I THINK THEY WILL BE INTERESTED, BUT THERE IS A TENDENCY IN EUROPE TO SEE THEM AS DIFFICULT, AS THEY DON'T GIVE IN AND WE SEE THEM IN TERMS OF BATTLE. YOU HAVE TO TURN IT AROUND.

SECONDLY; IN YOUR PRESENTATION IT'S NOT VERY RELEVANT BUT IN THE WORLD IT IS VERY RELEVANT: I AM TALKING ABOUT THE BIOLOGICAL. YOU NEED TO DEFINE THE EUROPEAN UNION IN RELATION TO THE BIOLOGICAL. THIS IS A POTENTIAL SOURCE OF INCOME. THEY HAVE LARGE NUMBERS FOR FARMERS ALL OVER THE WORLD. IT'S ALREADY BIG AND WILL BE MUCH AND MUCH BIGGER.

AND THEN OF COURSE THERE IS THE CHALLENGE OF HOW THIS TRANSLATES TO THE TRADE POLICIES. WHAT DOES IT MEAN IF YOU SAY 'I WANT A ZERO CO2 EUROPE?' WHAT DO YOU ALLOW YOURSELF IN THAT DISCUSSION TO THE WORLD AT LARGE? I COULD GO ON AND ON, BUT THESE ARE FEW REMARKS YOU CAN DO SOMETHING WITH. THANK YOU.

K. NICOLAIDIS: YES, THANK YOU FOR FASCINATING PRESENTATION.

JUST THREE COMMENTS AND ONE QUESTION. ONE, VERY QUICKLY, IT SEEMS TO ME THAT IN THE STORY ABOUT COST, WHICH OF COURSE FOCUSES ON THE MIND OF POLITICIANS, THAT THE FIGURES ON THE PAGE 14 ON THE DECREASING COST ARE CRUCIAL. I SOMEHOW HEARD THERE WAS AN IMPLICIT KIND OF GEOPOLITICAL CALCULATION THERE, SO IT WOULD BE REALLY INTERESTING TO HEAR WHAT'S BEHIND THOSE CALCULATIONS, AS THEY ARE VERY BIG NUMBERS ON PAGE 14.

THE SECOND POINT IS, WITH MY HEAD AS PART OF THE REFLECTION GROUP

AND OUR HORIZON BEING 2030, I WANT TO RAISE THE ISSUE OF 2030 AS A HALF-LIFE FOR YOUR PROJECT. YOU ARE GIVING US A HORIZON OF 40 YEARS AND OF COURSE WE KNOW THAT POLITICAL HORIZON IS MORE A PERIOD OF 1 YEAR, AS RUUD CAN TELL US AS HE HAD A LONGER POLITICAL HORIZON, BUT LET'S SAY WE'LL TAKE 20 YEARS. IT WOULD BE REALLY NICE TO HAVE A MOMENT WHERE YOU TELL US A BIT MORE ABOUT THE HALF-LIFE, THIS WILL FOCUS THE MIND OF POLITICIANS A BIT MORE.

FOR INSTANCE, ONE THING THAT WORRIES ME IS THAT ON PAGE 15 THE GRAPH ON THE INCREASING COST WHICH THEN DECREASES, 2030 IS THE PEAK, SO WE HAVE A KIND OF THRESHOLD PROBLEM. IS THERE A TIPPING POINT OF WHAT'S HAPPENING THERE WITH 2030? WHAT DOES IT TELL US ABOUT POLITICAL FEASIBILITY? THE DIFFERENCES BETWEEN THE TECHNOLOGICAL HORIZON AND THE POLITICAL HORIZON ARE THAT THERE MIGHT NEED TO BE SOME MORE THINKING ABOUT THE HALF-LIFE ISSUE.

MY THIRD SET OF POINTS HAS TO DO WITH IN A WAY WITH THE TITLE OF YOUR PRESENTATION ZERO CARBON EUROPE. THE WHOLE PRESENTATION IS AROUND 80% AND THERE IS A REAL ISSUE ABOUT WHAT THE MESSAGE IS: IS IT ZERO CARBON? THIS IS A REALLY ATTRACTIVE SLOGAN, POLITICAL SLOGAN; THAT CAN INSPIRE BOTH THE MASSES AND THE ELITE.

THERE IS AN ISSUE THERE AND I UNDERSTAND YOUR INTELLECTUAL STRATEGY, IF YOU ALLOW ME TO PUT A GLOSS TO YOUR STRATEGY, BECAUSE YOU'RE TRYING TO PREEMPT OBJECTIONS. THE WAY YOU DO IT IS; FIRST YOU JUSTIFY YOUR EURO-CENTRISM (WHICH I THINK IS GREAT: THE CLASSIC 'LET'S BE INDEPENDENT') BUT ALSO THERE IS THE VERY IMPORTANT ARGUMENT WHICH I THINK COULD BE BROUGHT OUT, WHICH IS: WHAT MATTERS IN THE END IS WHAT IS CONSUMED IN PLACE. WE CAN'T GO FOREVER THINKING ABOUT THE PRODUCTION MEASUREMENT OF CARBON. IT'S OUR CONSUMPTION PATTERN AND GETTING THE TWO CLOSER TOGETHER, OTHERWISE THE CARBON LEAKAGE PROBLEM ON GLOBAL VIEW POINT IS HUGE.

ON THAT BASIS YOU HAVE TWO STRATEGIES, TWO POLITICAL STRATEGIES. I SEE THEM AS THE TWO A'S: ALTERNATIVES AND DEGREES OF AMBITION.

THERE'S 50%  
CHANCE THAT IN  
2030 NUCLEAR  
FUSION MIGHT  
HAPPEN.

ALTERNATIVE IS SIMPLE, AS YOU EXPLAINED IT VERY WELL WITH THE THREE PATHWAYS, BUT I WOULD BE SO CURIOUS FOR YOU TO JUSTIFY THAT. YOU SAY 'LOOK, THERE ARE THESE WAYS TO GET TO 80%, TO THE SAME TARGET', BUT THEN WHY THE CEILINGS? WE REALLY NEED TO HAVE A STORY ABOUT THE CEILING. WHY IS THE CEILING FOR CCS 30% OR FOR NUCLEAR 30%? COULD IT BE OTHERWISE? IS IT YOUR DECISION? SO ARE WE TALKING ABOUT CEILINGS WHERE REALLY, AFTERWARDS, THE MARGINAL COST AFTER THE TARGET OF 80% BECOME MUCH BIGGER? WHAT'S GOING ON WITH THESE NUMBERS?

THEN YOU HAVE A SEPARATE STRATEGY (IT'S SO IMPORTANT TO DISTINGUISH THEM) WHICH IS THE DEGREE OF AMBITION WHERE YOU JUMP FROM 80% TO 100%. WHAT I THINK YOU ARE TRYING TO SAY IS: IN THE ADDITIONAL 20% WE FIND ALL THE POLITICAL UNCERTAINTIES, AND MY IDEA WOULD BE THAT YOU WOULD REALLY RATE THEM IN TERMS OF DEGREE OF POLITICAL UNCERTAINTY. THIS IS WHERE WE NEED TO TAKE A STAND.

YOU WILL KNOW VERY QUICKLY ABOUT NUCLEAR FUSION. AT OXFORD WE HAVE SIR DAVID KING WHO'S LEADING THE SMITH INSTITUTE AND THE ENVIRONMENT, AS YOU KNOW, BUT HE'S ALSO THE HEAD OF THE PROJECT ON NUCLEAR FUSION. I WAS HAVING A LUNCH WITH HIM A FEW DAYS AGO AND HE'S SAYING TO ME THAT THERE'S 50% CHANCE THAT IN 2030 NUCLEAR FUSION MIGHT HAPPEN. IT WOULD BE NICE TO HAVE SOME SORT OF PROBABILISTIC ASSESSMENT ON THIS TECHNOLOGY. SO THERE IS A TECHNOLOGICAL UNCERTAINTY AND THEN YOU HAVE GEOPOLITICAL UNCERTAINTY, AS LUC WAS MENTIONING: NORTH AFRICA. YOU ARE SAYING 'LOOK, IF SOMEONE WHO'S LISTENING TO ME HAS THE GITTERS ABOUT NORTH AFRICA, IT ONLY CONCERNS 80% TO 100%'. WHAT MY AMENDMENT WOULD BE, IS TO SAY: THE 80% TO 100% IS CRITICAL IN TERMS OF THE SLOGAN, AS IT IS ALSO THE TITLE OF YOUR PRESENTATION WHAT INSPIRES, SO I WOULD ADD A KIND OF A SECOND PART TO THE 80%.

I WOULD LIKE TO MAKE TWO MORE POINTS. FIRST, WHAT IF WE ADD SOME NEW MATERIAL TO THE UNCERTAINTY OF NORTH AFRICA OR NUCLEAR FUSION AND THE SECOND PART IS OUR 80% SCENARIO. THESE ARE TWO RATHER DIFFERENT STORIES AND IN THE END THERE'S A TWIST TO THIS (WHICH I THINK IS IMPLICIT IN SOME OF THE COMMENTS). TAKE THE POLITICAL UNCERTAIN PART, AS YOU KNOW THERE WAS THE DIVINE SURPRISE THAT THE NORTH AFRICA BECOMES STABLE AND DEMOCRATIC, AND ADD FUSION HAPPENING IN 2030 THAT COULD HELP US FOR THE 80%. THEN YOU BRING IT ALL BACK IN, YOU HAVE TAKEN IT OUT FOR POLITICAL REASON BUT THEN YOU BRING IT BACK IN. THERE ARE THESE DIFFERENT STRATEGIES. I'M TRYING TO READ WHAT YOU HAVE DONE AND PERHAPS SUGGEST IT MIGHT BE DONE EVEN MORE EXPLICITLY, BECAUSE WHAT CONCERNS ME IS THE POLITICAL MESSAGE.

I WOULD SUGGEST TO BASE THE MISSION ON HOPE INSTEAD OF FEAR. I THINK WE SHOULD LOOK MORE AT HOPEFUL THINGS BECAUSE THERE ARE A LOT OF OPPORTUNITIES WHICH HAVEN'T BEEN EXPLORED.

I FOUND TWO MAIN ISSUES HERE, WHICH CAN ALSO CONTRIBUTE TO MAKE IT REALLY HAPPEN. FIRST IS TO THINK ABOUT THE REDUCTION OF THE ENERGY DEMAND. WHAT I FOUND IN YOUR ENERGY CHARTS IS THAT THE ENERGY DEMAND WILL RISE: IT WILL AND IT DOES ALL THE TIME. SO HOW ABOUT TO ACTUALLY REDUCE IT, THEN IT WILL BE MUCH EASIER TO COVER EVERYTHING WITH RENEWABLE ENERGY.

THE SECOND POINT IS, WHICH I THINK IS THE KEY ISSUE, IS THE SHIFT

R. KOOLHAAS: I THINK THAT ON THE ONE HAND THERE ARE VERY MANY ENCOURAGING THINGS IN THE MESSAGE THAT YOU CAN [DECARBONIZE THE POWER SECTOR] WITH CURRENT TECHNOLOGY AND THAT YOU DON'T HAVE TO CHANGE ANYTHING FUNDAMENTALLY. THE ONLY THING THAT YOU HAVE TO RADICALLY CHANGE IS HOW EUROPE WORKS... WHICH MIGHT BE ANOTHER CONSIDERABLE AGENDA.

H. SCHUSTER: THANKS FOR TWO PRESENTATIONS WHICH ARE ACTUALLY NOT THAT NEGATIVE AS MOST OF THE DISCUSSIONS GOING ON IN NEWSPAPERS AND TV. IT'S TECHNICALLY POSSIBLE EFFORT. SECOND, WE HAD THROUGHOUT THE WORLD QUITE A RANGE OF DIFFERENT SITUATIONS, WHICH HAVE BEEN OVERCOME SOMEHOW, SO WHY NOT THIS.

FROM INVESTMENT COSTS TO OPERATION COSTS. THIS IS SOMETHING WE FIND IN THE EVERYDAY WORLD ACTUALLY. THAT MAIN CONSTRAINT OR MAIN LIMIT IN REALIZATION, FOR EXAMPLE OF ZERO ENERGY BUILDINGS, IS EXACTLY THIS POINT. IF WE REALLY WANT TO REALIZE THAT, IT HAS TO BE FROM A POLITICAL SIDE. IT HAS TO BE TOUCHED THAT THE INVESTMENT COSTS ARE NOT THE ONES WHICH ARE REALLY COUNTING FOR EVERYTHING. THAT LEADS TO THE SOCIAL PROBLEM, MORE OR LESS, THAT EVERYBODY MUST BE IN THE BOAT TO REACH THAT TASK INCLUDING THE HOUSEHOLDS FOR EXAMPLE. THIS IS WHAT I THINK THE MAIN COMBINATION AND THESE ARE THE MAIN CHALLENGES HERE.

E. DE MULDER: I AM A STRONG ADVOCATE FOR RENEWABLE ENERGY. BUT I WONDER IF THE MISSION DRIVE IS STRONG ENOUGH FOR THIS. IS THE EUROPEAN CITIZEN PREPARED NOT TO BUY 1.5 DESIGNER PAIR OF SHOES? I WONDER BECAUSE RIGHT NOW THE DRIVE IS BASED ON FEAR, THE FEAR FOR CLIMATE CHANGE AND THE IMPACT OF THAT WHICH IS REAL NOW IN THIS POLITICAL CONTEXT. I WONDER IF THAT STILL SETS THE CASE IN 5 YEARS OR 10 YEARS TIME. IT'S A HOT POLITICAL ISSUE NOW OF COURSE RECENTLY, BUT WILL THAT LAST FOR A LONGER TIME. WILL THE EUROPEAN CITIZEN BE PREPARED TO GO ON WITH THIS MISSION? TO GO ALONG THAT ROUTE? I WOULD SUGGEST TO BASE THE MISSION ON HOPE INSTEAD OF FEAR. I THINK WE SHOULD LOOK MORE AT HOPEFUL THINGS BECAUSE THERE ARE A LOT OF OPPORTUNITIES WHICH HAVEN'T BEEN EXPLORED.

BESIDES RENEWABLE ENERGY IT IS ALSO GOOD TO LOOK AT OTHER THINGS TO CONTRIBUTE TO OUR EUROPEAN ENERGY BALANCE. FOR EXAMPLE SAVING ENERGY, IS STILL NOT SUFFICIENTLY EXPLOITED.

I AM DEFENDING THE UNDERGROUND TO THE SUB-SAHARA BECAUSE I AM THE GEOSCIENTIST AND I HAVE LEARNED TO LOOK AT THE UNDERGROUND CITIES. I THINK THAT THERE ARE A LOT OF OPPORTUNITIES. LOOK AT CHINA WHERE ARE THESE UNDERGROUND CITIES REALLY VERY WELL DEVELOPED, LOOK AT ALL THE ENERGY SAVINGS WHICH COULD BE GENERATED FROM THEM. LOOK AT THE FUTURE AND WE SHOULD LOOK FOR HOPES FOR FUTURE DEVELOPMENTS RATHER THAN FOR FEAR.

R. SEEGER: I FULLY AGREE WITH THAT. IF YOU REALLY WANT TO REMOVE THE NEEDLE YOU HAVE TO GET OUT OF THIS NEGATIVE CORNER, YOU SHOULD MAKE INVENTORY OF WHO IS EXPECTED TO BE AGAINST THIS. WE CAN KNOW NOW WHO WOULD LIKE TO BE OPPOSE TO THIS. IF YOU WANT TO GET POLITICIANS MOVING IT SHOULD NOT BE A NEGATIVE MESSAGE SENT BY FEAR, YOU HAVE TO SELL THIS. I WORK FOR COCA-COLA, I AM NOT A MARKETER BUT I KNOW A LITTLE BIT ABOUT IT. YOU HAVE TO SELL THIS MESSAGE IN A VERY CLEVER WAY.

SECONDLY, 2050 IS SO FAR AWAY AND SO DIFFICULT TO UNDERSTAND. CAN WE IDENTIFY A FIRST STEP THAT IS TANGIBLE, THAT PEOPLE CAN COMPREHEND, THAT THEY CAN ALMOST TOUCH TO SHOW WHAT THE WAY FORWARD IS? IS THAT A THING THAT'S INCLUDED IN THE PLAN OR ARE WE JUST GOING TO SEND THE MESSAGE FOR 2050?

R. DE GRAAF: I THINK IT'S A FUNDAMENTAL AMBIGUITY IN THE WHOLE

THE LIKELIHOOD OF TECHNOLOGICAL BREAKTHROUGHS BY 2050 IS CONSIDERABLE.

EXERCISE. PART OF THIS IS DESIGNED TO LOWER THRESHOLD TO EMBARK ON IT, BUT AT THE SAME TIME THE HORIZON WE ARE TALKING ABOUT IS 40 YEARS AWAY... 40 YEARS AGO IT WAS 1970. THE EUROPEAN UNION AT THAT TIME I THINK HAD ABOUT 11 MEMBERS, SO IT IS PLAUSIBLE THAT EUROPE IN 2050 WILL HAVE MORE THAN 27 MEMBERS. THIS IS VERY LIKELY. IT IS ALSO PLAUSIBLE THAT IN THAT TIME REALM OF COURSE THERE WILL BE TECHNOLOGICAL DEVELOPMENT. DEVELOPMENTS WON'T STAND STILL. STATISTICALLY, THE LIKELIHOOD OF TECHNOLOGICAL BREAKTHROUGHS BY 2050 IS CONSIDERABLE. BUT SINCE YOU CAN NEVER PLAN BREAKTHROUGHS AND SINCE DECISIONS OF ALL THINGS TAKE PLACE IN THE IMMEDIATE PRESENT YOU NEED TO PLAY DOWN THOSE EFFECTS PARTY IN ORDER TO GET THE BUY IN. OF COURSE WE ALL KNOW THAT TO SPECULATE ON THESE EFFECTS IS THE MOST DISTINGUISHING THING OF SUCH A PROJECT.

R. LUBBERS: KALYPSO SPOKE ABOUT 2030, IT SEEMS TO ME IT HAS TO BE YOUR MISSION, YOUR KEY. OKAY, THAT IS A FACT. THIS MEANS THAT 2030 LEADS TO SOMEWHERE. THIS FITS IN THE EXERCISE, IT FITS IN THE KIND OF THINKING. BUT DO YOU AGREE THAT IT IS RISKY TO SPEAK ABOUT ONLY 80% WHICH IS IN FACT 100% BY 2050? IT WOULD BE GOOD TO TRANSLATE THAT INTO AN INTERMEDIATE STEP THAT IS PLAIN AND SIMPLE.

J. RUYS: IN TERMS OF TIME, WE WOULD ALSO LIKE TO SHIFT GEARS A LITTLE BIT. IF WE WERE TO SAY THAT EVERYONE WOULD START TO TALK

## ENTREPRENEURS WERE THE ONES WHO FOUNDED THE NEW BRANDS WHICH PROMPTED THE REVOLUTION.

ABOUT THIS PROJECT IN THE NEXT 20 YEARS WE WOULD SAY THAT THIS PROJECT IS A SUCCESS. WE DO NOT WORRY ABOUT THE END, WE KNOW WHERE WE ARE GOING, WE KNOW IT IS POSSIBLE AND A LOT OF WORK NEEDS TO BE DONE AFTER WE FINISH. I HEARD A LOT OF REMARKS AND WHAT I HEARD YOU SAY IN TERMS OF WHY THIS IS IMPORTANT OR WHAT THE CHALLENGES ARE. FIRST, MAKE SURE YOU HAVE A BUSINESS CASE TO CHANGE AWAY FROM THE NEGATIVE

TO THE POSITIVE INSPIRING STORY THAT THEY CAN SELL AND ALSO MONEY WISE. THEN I THINK WE ALSO HEAR TO MAKE IT "THE EUROPEAN PRIORITY". NOT A PRIORITY, BUT GIVE THEM A GOAL AND THIS COULD BE ONE THAT WE CAN START IN THE NEXT YEAR. THIRD: MAKE IT REAL FOR PEOPLE, MAKE IT REAL FOR POLITICIANS, MAKE IT REAL FOR CITIZENS, AND TALK ABOUT THE INTERMEDIATE STEPS, REALISTIC STAGES THAT PEOPLE CAN RELATE TO. WE HAVEN'T TALKED ABOUT TECHNOLOGY YET AND WE HAVEN'T TALKED ABOUT REGULATION.

SO WHAT I WOULD LIKE TO KICK OFF IN THE REMAINING 20-ODD MINUTES WITH THIS. CAN YOU GIVE US SOME VERY PRACTICAL SUGGESTIONS THAT WE CAN INCORPORATE INTO REPORT, SO WHEN WE PRESENT THIS TO THE EU AND SAY TO THEM: 'WE THINK THIS IS WHAT YOU HAVE TO DO TO OVERCOME THESE CHALLENGES.'

K. VAN DER LEUN: I WAS THINKING ABOUT THE FILM YOU SHOWED, THE INDUSTRIAL REVOLUTION AND THE INTERNET REVOLUTION AND THE THOUGHT THAT CAME TO MY MIND WAS THAT IT WAS PRETTY MUCH ENTREPRENEUR DRIVEN. YOU KNOW, ENTREPRENEURS WERE THE ONES WHO FOUNDED THE NEW BRANDS WHICH PROMPTED THE REVOLUTION AT THE END OF IT ALL.

IN THIS CASE I FOUND IT A BIT TOUGHER TO SEE WHICH ENTREPRENEURS ARE GOING TO BE THE ONES WITH THE APPLE OF THE ENERGY REVOLUTION WE ARE GOING TO SEE AND THAT THERE IS MUCH MORE A LEADING ROLE FOR POLITICIANS FOR INFRASTRUCTURAL DECISIONS.

IN YOUR REPORT YOU COULD REALLY TRY TO SEPARATE WHERE WE SEE THE ENTREPRENEURS TAKE THE LEAD AND WHERE SHOULD POLITICIANS OR OTHER INFRASTRUCTURE PLAYERS TAKE THE LEAD. THEN, I THINK WE'RE GOING TO BEGIN TO SEE HOOKS OF WHERE PRIVATE MONEY AND INVESTMENTS WILL DRIVE AND WHERE FIRST CONDITIONS WILL NEED TO BE SHAPED BEFORE THAT REVOLUTION CAN START. THAT'S GOING TO BE CRUCIAL.

M. VAN DIJK: LET ME SAY SOMETHING TO BUILD ON THIS. I LISTENED TO THE STORY AGAIN AND I THINK THAT THERE SEEMS TO BE A DILEMMA OR INCONSISTENCY. ON ONE

## THE PRICING WILL DRIVE INVESTMENT.

HAND I THINK WE NEED A STORY ABOUT THE ENTREPRENEURSHIP. WE ALL KNOW WE'VE GOT MANY SOLAR COMPANIES, MANY WIND COMPANIES, WHO WOULD LOVE TO INVEST IN THIS BUT THEY ALL EXPECT INCREASING PRICES TO MAKE THEIR BUSINESS SWING. THEN YOU WOULD ASSUME A FUTURE WHERE THE CHARGES WILL BECOME HIGHER AND HIGHER, FUEL BASE ENERGY BECOMES MORE EXPENSIVE AND OVERALL PRICES WILL INCREASE, AND THEREFORE ALL THESE ENTREPRENEURS WILL RUN.

ANOTHER SCENARIO WAS ONE QUITE SIMILAR TO TRANSPORT, BECAUSE IT'S ALL INFRASTRUCTURE BASED, IT'S ALL FIXED COST, NO VARIABLE COST. IN THE MOMENT PEOPLE STARTED PUMPING MORE AND MORE OF THIS INTO THE SOCIETY, THE PRICES WILL DROP DRAMATICALLY, THE INTERNET COMPANIES WENT BANKRUPT, THE RAILROAD COMPANIES WENT BANKRUPT AND PRICES REALLY WENT DOWN.

YOU CAN SEE THAT ALSO IN THE FUTURE FOR EUROPE ONCE YOU HAVE GOT YOUR SCENARIO OF 80% TO 100% RENEWABLE. ALMOST ALL THE ELECTRICITY COMES WITH FIXED COST. VARIABLE COSTS ARE ALMOST ZERO AND YOU'VE GOT VERY LOW COST, LOW PRICE ENERGY EUROPE WHICH WILL DRIVE ECONOMIC ROLE AS WELL. IS THIS A STORY WHERE OVER IN COMING YEARS ENERGY PRICES WILL BECOME VERY HIGH AND IT WILL STIMULATE A LOT OF ECONOMIC ENTREPRENEURS? WILL THEY DROP TO THE FLOOR, OR WILL THEY HAVE A HUGE ECONOMIC GROWTH WHEN THE SOLAR AND WIND COMPANIES WILL GO ALL BANKRUPT IN THE MEANTIME? WHAT IS THE SCENARIO HERE? BECAUSE IN THE MIDDLE OF THE TWO IS WHEN NOTHING HAPPENS.

WHAT IS THE PRICING DYNAMIC WE'RE FORECASTING HERE? THIS INDUSTRY IS HEAVILY PRIVATIZED, THE PRICING WILL DRIVE INVESTMENT.

M. RUIS: I WAS LOOKING ALSO AT THE SPATIAL ASPECT OF THE USE OF ENERGY. IF I LOOK AT LEAST AT THE NETHERLANDS IN THE DUTCH SPATIAL PLANNING, THE ATTENTION NOW IS PAID TO THE ENERGY AND THE ELEMENT OF ENERGY. WE'VE TALKED ABOUT EUROPEAN DIMENSION BUT ALSO IN THE NATIONAL LEVEL THERE IS NOW ATTENTION PAID TO IT. AND I THINK IT WOULD BE WORTHWHILE TO PAY MORE ATTENTION IF YOU SAY THAT THE GOVERNMENT AND, SHOULD PAY ATTENTION TO IT THEN IN THE END YOU CAN PAY ATTENTION ON THE EUROPEAN LEVEL. SO I THINK THAT SHOULD BE ONE.

R. DE GRAAF: WE HAVE DONE A PROJECT FOR THE NORTH SEA AND TRY TO SPEAK TO YOUR MINISTRY FOR QUITE SOME TIME.

R. KOOLHAAS: BUT I THINK IT'S TYPICAL THAT IT TOOK US MONTHS.

R. DE GRAAF: WE DID A PROJECT FOR THE NORTH SEA, THIS HUGE WIND RING IN THE NORTH SEA. ALMOST A DAY AFTER THE PRESENTATION WE WERE ON THE 8 O'CLOCK NEWS. THERE WAS HUGE MOMENTUM, NEVERTHELESS ONLY THEN THE PROBLEM BECAME THE HUGE LABYRINTH TO WHO TO ACTUALLY SPEAK TO FOSTER THIS SCALE OF PROJECT, WITH ALL THE DIFFERENT EUROPEAN COUNTRIES, IT ALSO SEEMS TO BE MULTIPLICATED.

L. BAS: I WOULD LIKE TO RECOMMEND WHO TO ADDRESS, BECAUSE THE ISSUE IS SUCH AN INTEGRATED PROBLEM, SO THE ONLY SOLUTION THERE IS TO GET POLITICAL WILL FROM THE PRIME MINISTERS, REALLY...BE VERY PRECISE IN WHAT YOU ASK TO THE EUROPEAN COUNCIL. I THINK YOU WILL ALSO HAVE TO GIVE THIS VISIONARY 2050 VIEW THAT IT HAS TO BE CONSOLIDATED REPEATED ALL OVER AGAIN. BUT ON THE SHORT TERM I THINK YOU HAVE TO SEND CLEAR MESSAGE HOW THE EU BUDGET IS BEING INVESTED. EVEN IF

WHY DON'T  
WE PUSH FOR  
A TREATY ON  
RENEWABLE ENERGY  
IN THE EU?

IT'S SMALL, RELATIVELY SMALL BUDGET, THE EU BUDGET COMPARED TO INTERNATIONAL BUDGET, BUT IT CAN HAVE INCREDIBLE EXEMPLATORY ROLE, SO IT'S A CRUCIAL THING IF YOU LOOK AT MONEY THAT'S THERE FOR EXAMPLE IN RESEARCH AND DEVELOPMENT IT'S IN FP7 IT'S JUST VERY MARGINAL BUT IT GOES TO RENEWABLE ENERGY BUT LOOK AT WHAT STILL GOES TOWARD NUCLEAR

RESEARCH, BUT IT'S REALLY STRIKING IT'S STILL GOING TO NUCLEAR RESEARCH. AND, FUSION, I FIND IT VERY INTERESTING TO HEAR THAT PROBABILITY OF FUSION IS GETTING CLOSER CSP IN NORTH AFRICA. I FIND IT VERY INTERESTING TO HEAR. AND ON THE HIGHER LEVEL WHAT YOU COULD CONSIDER THERE WAS A TREATY ON EUROPE, WHY DON'T WE PUSH FOR A TREATY ON RENEWABLE ENERGY IN THE EU? PUT IT REALLY UP TO THAT LEVEL, BOOST THE INDUSTRY, SO THAT COULD BE VERY HIGH LEVEL MESSAGE SO WHY DON'T YOU TRY AND SEE IF YOU GET A RENEWABLE ENERGY TREATY. AND MAYBE ON THE SHORTER TERM AND TIED INTO ENERGY EFFICIENCY, WE SEE THAT RENEWABLES ARE PROGRESSING IN EUROPE AND THERE IS A TARGET, AND POTENTIALLY A BINDING TARGET, BUT ALSO OPPORTUNITY SHARING AMONGST THE MEMBER STATES BUT IT MAY BE VERY USEFUL FOR THE DEMAND SIDE.

L. BAIRD: IT BRINGS UP A LARGER QUESTION AS WELL BECAUSE WE'VE HEARD A COUPLE OF WAYS TO APPROACH IT. ONE IS THIS GOING STRAIGHT TO THE COUNCIL AND HAVING IT BE A TOP-DOWN APPROACH, BUT THERE'S ALSO A QUESTION OF WHETHER IT WOULD BE MORE EFFECTIVE AS A BOTTOM-UP APPROACH. IS THE EUROPEAN CITIZEN GOING TO FORGO THE 1,5 DESIGNER SHOES TO INVEST IN THIS? SO MAYBE IT'S SOMETHING THAT WE COULD SPEAK TO: DO YOU ATTACK IT FROM THE TOP-DOWN OR BOTTOM-UP? IS IT FIRST ADDRESSED ON A MEMBER STATE OR REGIONAL LEVEL BEFORE EXPANDING IT TO THE ENTIRE EU? I'D LIKE TO HEAR SOME INPUT INTO THAT.

K. NICOLAIDIS: FIRST OF ALL THIS IS REALLY USEFUL FOR US BECAUSE WE'RE SUPPOSED TO COME UP WITH THIS TOO, AS YOU KNOW, AND TO GROUND

THERE MUST BE  
A MOMENT WHERE  
YOU MANAGE TO  
SHIFT THE BURDEN  
OF PROOF TO THE  
ACTORS WHO DON'T  
INTERCONNECT.

OUR RECOMMENDATIONS IN SUCH DEEP RESEARCH IS REALLY IMPORTANT.

I WOULD LIKE TO SPEAK TO FOUR POINTS: ONE IS ON THE PUBLIC AS LAURA WAS JUST SAYING, CAN YOU SUM UP IN A SET OF THREE POINTS THE GOALS THAT THE PUBLIC CAN RELATE TO AND HOLD THEIR POLITICIANS ACCOUNTABLE FOR? REINIER SHOWED US THE RASMUSSEN REPORT, 59% (THIS IS VERY SCARY, I HAVEN'T SEEN THE LATEST NUMBERS) ARE SKEPTICAL, SO THERE'S A WHOLE PR TO

THIS: IF SHOW YOUR FILM IN EVERY EUROPEAN TV CHANNEL, YOU COULD HAVE AN IMPACT.

ON LUC'S COMMENT ABOUT PRIME MINISTERS: ONE THING THAT I FIND FASCINATING IS THAT OF COURSE IF YOU'RE GOING TO GIVE THEM THE SHORT TERM TARGET, IT'S NOT AN AFTER TAX TARGET, IT'S MORE ABOUT NAMING SHAMING AND PRAISING A BENCHMARK. POLITICIANS WHY WANT TO KNOW WHAT'S IN IT FOR THEM IN SHORT TERM, SO HOW DO YOU CREATE THIS KIND OF BENCHMARK? LIKE THE OPEN METHOD OF COORDINATION IN THE EU, THAT'S WHAT THEY'LL NEED TO KNOW. THIS KIND OF PROJECT PRESSURE IS FASCINATING FROM YOUR PRESENTATION, ESPECIALLY WHEN YOU CONSIDER THE INTRODUCTION OF DIFFERENTIATED NATIONAL BENCHMARKS.

THE THIRD PART IS THE ENTRUPRENEUERS, SOMEONE WAS SAYING IT WAS ALL ABOUT THE ENTREPRENEURS, I THINK IT WOULD BE GREAT TO HAVE A REPORT OF THE COST OF NON-CARBON TECHNOLOGY AS AN INVENTORY FOR EUROPE, SHOWING WHAT THE OBSTACLES ARE FOR ENTREPRENEURS.

COUNTRIES  
GENERALLY WATCH  
EACH OTHER TO  
MAKE THE FIRST  
MOVE.

FINALLY, HOW DO YOU GET GOING ON THE REAL INFRASTRUCTURAL STRATEGY? HOW DO YOU GET POLITICIANS TO SIT DOWN AND TALK ABOUT INTERCONNECTION OF THEIR INFRASTRUCTURAL GRID, WHEN COSTS ARE DIFFERENTIATED, BUT MOST OF ALL WHEN WE KNOW THERE ARE ACTUAL GEOPOLITICAL OBSTACLES TO BUILDING THE GRID? THERE MUST BE A MOMENT WHERE YOU MANAGE TO SHIFT THE BURDEN OF PROOF TO THE ACTORS WHO DON'T INTERCONNECT. RIGHT NOW, THE STATUS QUO IS TO NOT INTERCONNECT, SO THE BURDEN OF PROOF MUST BE SHIFTED, AND WE SHOULD CONSIDER THE POLITICAL WAYS TO DO SO.

R. LUBBERS: EUROPE WILL NEED TO ACCEPT THIS POLLUTER PAYS PRINCIPLE. MY IMPRESSION IS THAT THIS IS UNDERSTOOD BY EVERYONE, BUT IT IS NOT DONE UNTIL NOW. THE CO2 EUROPE AMBITION: ONCE WE HAVE MADE THAT CHOICE, ACCEPTED THIS EUROPEAN WIDE, THEN WE CAN DISCUSS MORE FUNDAMENTAL QUESTIONS OF HOW TO DO IT, WHETHER WITH THE EMISSION TRADING SYSTEM OR SOMETHING ELSE.

R. DE GRAAF: REPLACING THE EMISSION TRADING SYSTEM WITH SOMETHING ELSE IS IN ITSELF A HUGE OBSTACLE.

R. LUBBERS: THE PROBLEM IS THAT YOU NEED A LEVEL PLAYING FIELD TO BEGIN WITH. WHETHER THE ACCESS TO THIS COMES THROUGH THE EMISSION

TRADING SYSTEM OR SOMEWHERE ELSE IS NOT THE ISSUE IN THE BEGINNING, IF YOU ARE GOING TO MOVE FORWARD IF THE WHOLE WORLD IS GOING TO MOVE FORWARD, EUROPE CAN AND SHOULD ACCEPT THE CHALLENGE TO BE CO2 FREE BY 2050. REGARDLESS. WE TALK AND TALK AND TALK AND WE HAVEN'T SEEN IT YET.

R. DE GRAAF: THE PROBLEM IS OFTEN THAT THE BIG COUNTRIES GENERALLY WATCH EACH OTHER TO MAKE THE FIRST MOVE.

R. LUBBERS: YES, AND THIS WILL HAVE TO BE OVERCOME.

J. RUYS: DOES THIS BRING UP ANY FURTHER QUESTIONS OR COMMENTS?

T. ABRAHAMS: I THINK I GO BACK TO ONE OF THE BIGGEST CLIMATE CHALLENGES WHICH IS ACTUALLY AN INVESTMENT IN THE NETWORK. WHAT I DON'T HAVE A FEEL FOR IS HOW: IT HAS TO BE A PROCESS IN TERMS OF WHAT THE NETWORK SHOULD BE. YOU'VE GIVEN SOME BROAD FIGURES

IDEALLY IT WOULD BE GREAT TO TELL CITIZENS IN EUROPE THAT IN THE NEXT 40 YEARS WILL HAVE OUR OWN DECENTRALIZED ENERGY SUPPLY WHICH IS GREEN, WHICH BRINGS A LOT OF GREEN JOBS.

ABOUT WHERE THE BIG CONNECTIONS GO... I THINK THERE ARE POLITICAL ISSUES ABOUT IBERIA, FOR EXAMPLE. THIS FACT IS SO IMPORTANT FOR THE WHOLE BOOK OF THIS EUROPEAN PROJECT, I THINK THAT HAS TO BE A PRIORITY, BUT THE REGULATORY REGIMES NEED TO BE THERE TO MAKE IT PROFITABLE FOR THOSE LINKS TO BE MADE TO THOSE SORT OF NUMBERS AS SUCH THAT WE GOT TO LOOK AT THE COMMERCIAL SECTOR NOT THE EU BUDGET. SO HOW YOU ACTUALLY GOING TO MAKE THAT WORK AND HOW DO YOU GET THE SORT OF THE PROCESS OF THE RIGHT INCENTIVES TO PRODUCE THE NETWORKS BUT ALSO THE RIGHT INCENTIVES TO PRODUCE WHAT THE END OF THESE NETWORKS OF HOW THAT WORKS WILL BE QUIT HARD IF YOU HAVE IT AS A HIGH POLITICAL SUMMIT ON NETWORK OR NOT I DON'T KNOW.

C. VAN OESTROM: ONE MORE REMARK. WHAT WORRIES ME MOST AT THIS MOMENT IS THAT ALL OVER EUROPE THERE'S A LOT OF BUDGET CONSTRAINT AT THE MOMENT. I THINK THE DUTCH GOVERNMENT IS PLANNING TO SAVE 35 BILLION EUROS A YEAR IN THE NEXT 10 YEARS TO COME BACK TO THE OLD LEVELS OF FISCAL DEFICIT. I THINK THEN THAT THE RESULT OF THAT WILL BE THAT THERE WILL BE NO BIG PLAN OF CHANGE IN THE WHOLE ENERGY PLAN ALL OVER EUROPE. EVERY COUNTRY WILL HAVE DIFFICULTY WITH ITS OWN PEOPLE AND WILL TRY TO FIND WAYS OF NOT SPENDING MONEY. I KNOW SOME OF THE DUTCH POLITICAL PARTIES WERE SAYING RIGHT NOW LET'S SAVE 50% OF WHAT WE PAY IN EUROPE. SO IT WILL BE DIFFICULT TO LOOK AT EUROPE AND SEE THAT WILL HAPPEN THERE OVER THERE. AT THE SAME TIME THERE'S A LOT OF OPPORTUNITY MORE ON THE LOCAL LEVEL. FOR EXAMPLE IN THE BUILDING INDUSTRY WILL BE QUITE EASY IN THE NEXT FIVE YEARS TOO MANY BUILDING WILL BE CARBON NEUTRAL AND WILL COST EXACTLY THE SAME AMOUNT OF MONEY AS WE PAY TODAY. ENERGY SAVINGS WILL BE SOLD AND ALMOST THAT YOU CAN INVEST A LITTLE BIT MORE UPFRONT SAVE IT OF THE LIFETIME OF THE BUILDING. AND I THINK

THAT WE SHOULD BE LOOKING IN WAYS FOR THE SYSTEM OR OTHER SYSTEM THAT WILL GO OVER JUST A LITTLE BIT OVER EDGE TO INVEST INTO THOSE BUILDINGS TO INVEST IN THOSE CARS, AND ALL THOSE OPPORTUNITIES THAT ARE ALREADY OUT THERE. AND IF WE DO THAT, MY COMPANY IS DOING SO MUCH IN ABOUT THREE YEARS BY INVESTING IN GREEN BUILDINGS IF I LOOK AT THE NEXT TEN YEARS, WE WILL YOU KNOW WE'LL INVEST SO MUCH MONEY WE'LL LEARN MORE AND WE'LL LEARN FROM OUR MISTAKES AND GO ON. THAT IS HAPPENING THE SAME WITH THE ELECTRIC CARS THE SAME IS HAPPENING WITH SO MANY OTHER INDUSTRIES. AND TO GET THE FIRST MOVERS GOING, THE GOVERNMENT SHOULD DO THINGS THAT DO NOT COST MONEY, WHICH IS A GOOD THING, THE 32 BILLION, THE DUTCH GOVERNMENT WANTS TO SAVE BUT THEY HAVE TO BE SMART AND THERE HAS TO BE A SORT OF CONSENSUS ON HOW TO DO IT. THAT'S MY LAST REMARK.

WHAT I'M VERY MUCH WORRIED ABOUT IS THAT IN THE LAST FEW MONTHS A LOT OF PEOPLE REALLY DIDN'T TRUST THE GREEN MOVEMENT THAT SAID IN THE EMAIL: IT TURNS OUT THE IPCC WAS WRONG, WASN'T IT AND I THINK THAT IF YOU MAKE A REPORT AND YOU JUST SAY WE'VE GOT A NEW GREEN IDEA, THE WHOLE LOGO LET'S GO FROM BLUE TO GREEN A LOT OF PEOPLE WILL SAY: HEY! DIDN'T WE JUST FIND FACTS THAT IT ISN'T TRUE?

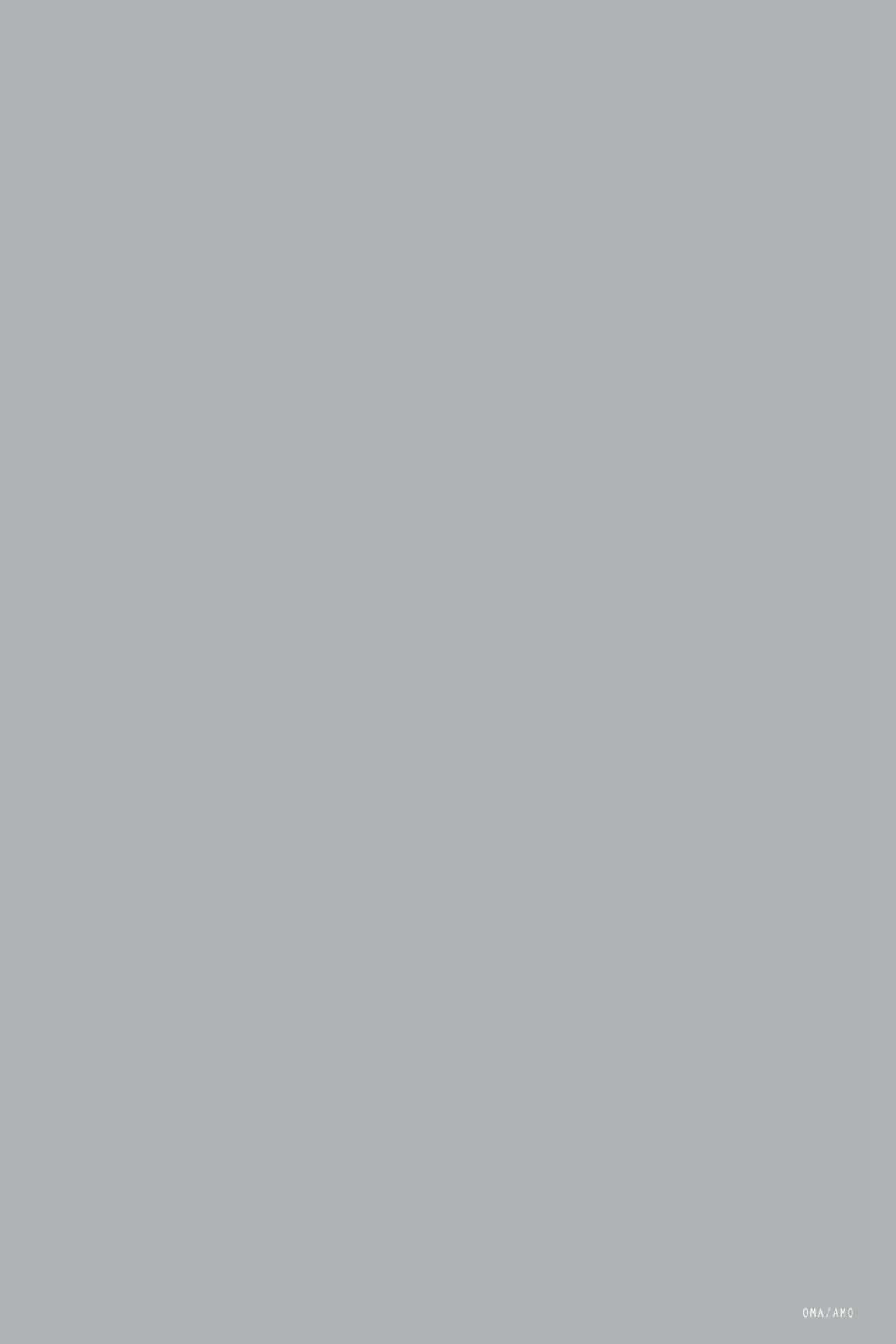
SO IF YOU LOOK AT THE WHOLE QUESTION WITHIN LET'S SAY OUR NEIGHBORS (AND ON THAT PART I MIGHT NOT AGREE WITH MR. LUBBERS) FOR THE NEXT YEARS IT MIGHT BE AT VERY DIFFICULT SITUATION WITH OUR OIL SUPPLY FROM MIDDLE EAST AND FROM RUSSIA. IDEALLY IT WOULD BE GREAT TO TELL CITIZENS IN EUROPE THAT IN THE NEXT 40 YEARS WILL HAVE OUR OWN DECENTRALIZED ENERGY SUPPLY WHICH IS GREEN, WHICH BRINGS A LOT OF GREEN JOBS, WHICH HAS A MIX THAT'S COMPLETELY DIFFERENT THEN IT WAS IN THE PAST. THEN YOU DON'T HAVE TO CONVINCE PEOPLE THAT THE POLES ARE REALLY MELTING. THERE'S A BIG PROBLEM COMING TOWARDS US WHICH I BELIEVE IS TRUE. FROM A PR PERSPECTIVE IT WOULD BE EASIER TO HAVE A SECOND SET OF REASONS TO DO IT.

J. RUYS: OK. I'M GONNA TRY TO RECAP IT.

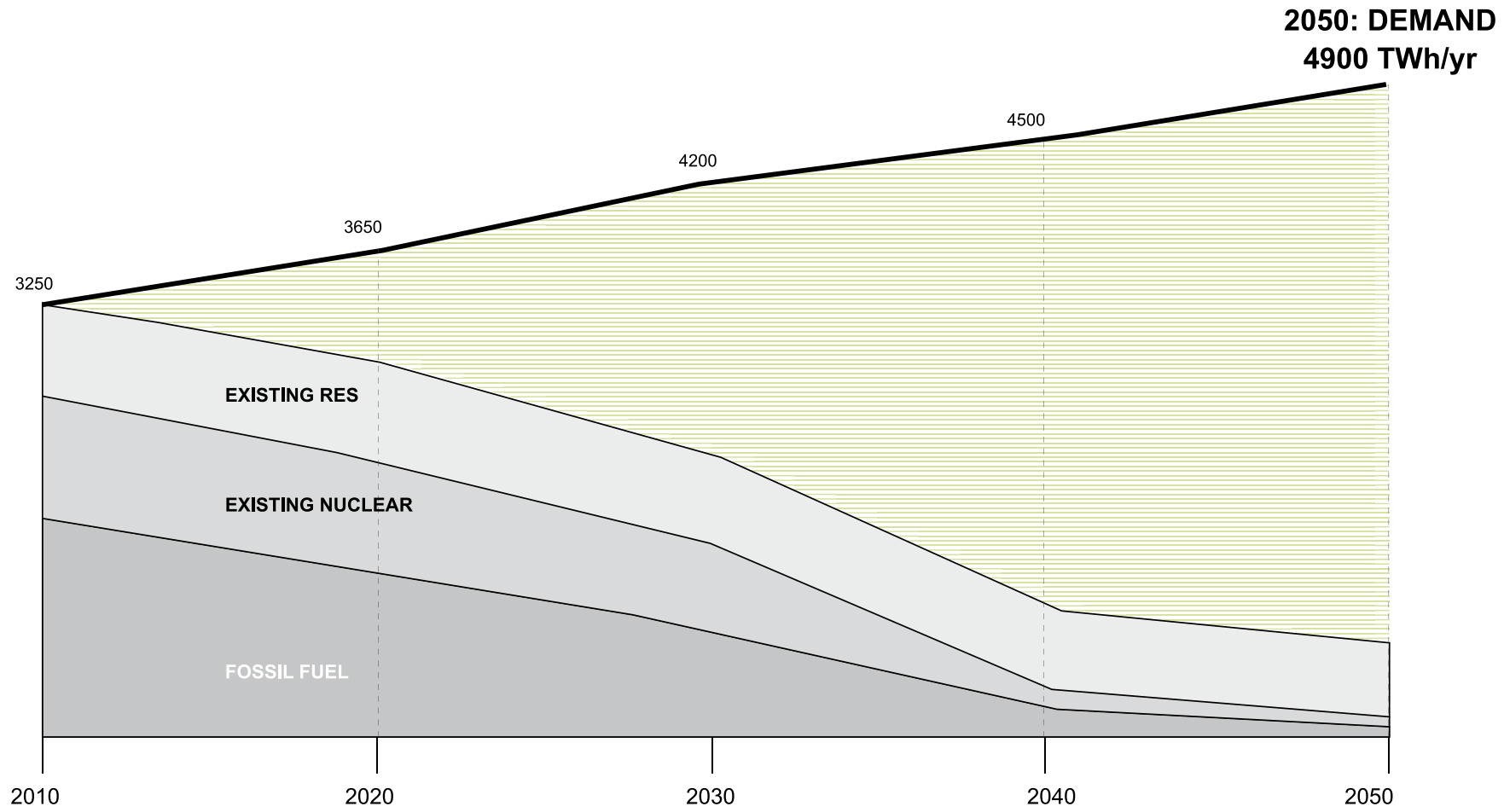
AGAIN, NOT TO COMPLETELY EXHAUST THE POINT, BUT LET ME FIRST SAY THIS IS EXTREMELY USEFUL FOR US: WE HAVE COMMENCED IN A PROJECT WHERE MANY OF THE ORGANIZATIONS WISHED US 'GOOD LUCK' WHEN WE STARTED THIS, BECAUSE IT'S SO COMPLEX AND THE AMBITION OF WHAT YOU'RE TRYING TO ACHIEVE IS SO HIGH...

AT THE SAME TIME WE REALIZE WE ARE NOT GOING TO 'SOLVE IT' IN THESE NINE MONTHS THAT WE HAVE WORKED TOGETHER ON THE PROJECT. IF THE RESULT OF THIS REPORT IS THAT WE CAN PROVIDE SOME FACTS THAT BASICALLY LEAVE PREVIOUS QUESTIONS IN THE PAST, PROMPTING THE AUDIENCE TO MOVE ONTO THE NEXT SET OF QUESTIONS, I THINK THIS WILL BE A SUCCESS ON OUR SIDE. A LOT OF THIS DISCUSSION WE ARE HAVING TODAY IS ACTUALLY ABOUT WHAT IS GOING TO BE DONE ONWARDS, AND YOU HAVE GIVEN SOME CONCRETE SUGGESTIONS. I'LL JUST REFLECT ON THE COUPLE OF THEM.

THE FIRST ONE TO START WITH: HOW YOU POSITION THIS IN THE CLIMATE VERSUS ECONOMY VERSUS ECOLOGY INDEPENDENCE DEBATE. GENERALLY YOU AGREE THAT WE NEED TO FIND SOMETHING THAT'S MORE ROBUST THAN JUST CLIMATES.



# ELECTRICITY DEMAND 2050 (EU27 PLUS NORWAY & SWITZERLAND)



Note Existing capacity includes new builds until 2010

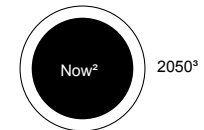
SOURCE: Roadmap 2050 Technical Analysis  
(McKinsey Power Generation Model)

Electricity Demand 2050

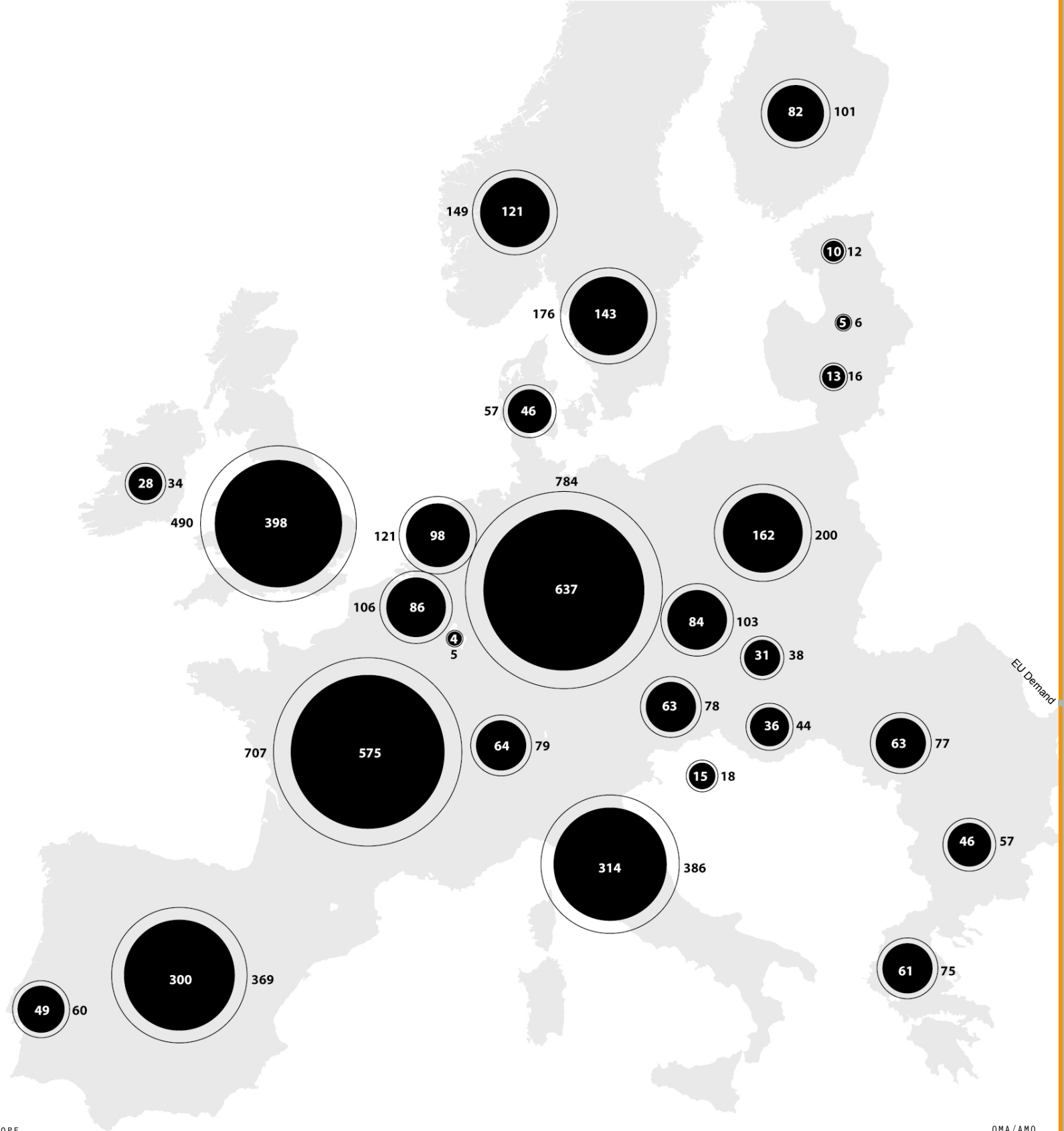


# ENERGY DEMAND 2050

ENERGY CONSUMPTION IN THE EUROPEAN UNION IN 2006 WAS 3354TWH/YR<sup>1</sup> IT IS ESTIMATED THAT DEMAND WILL BE 4900TWH/YR IN 2050.



KEY: Units: TWH/Year






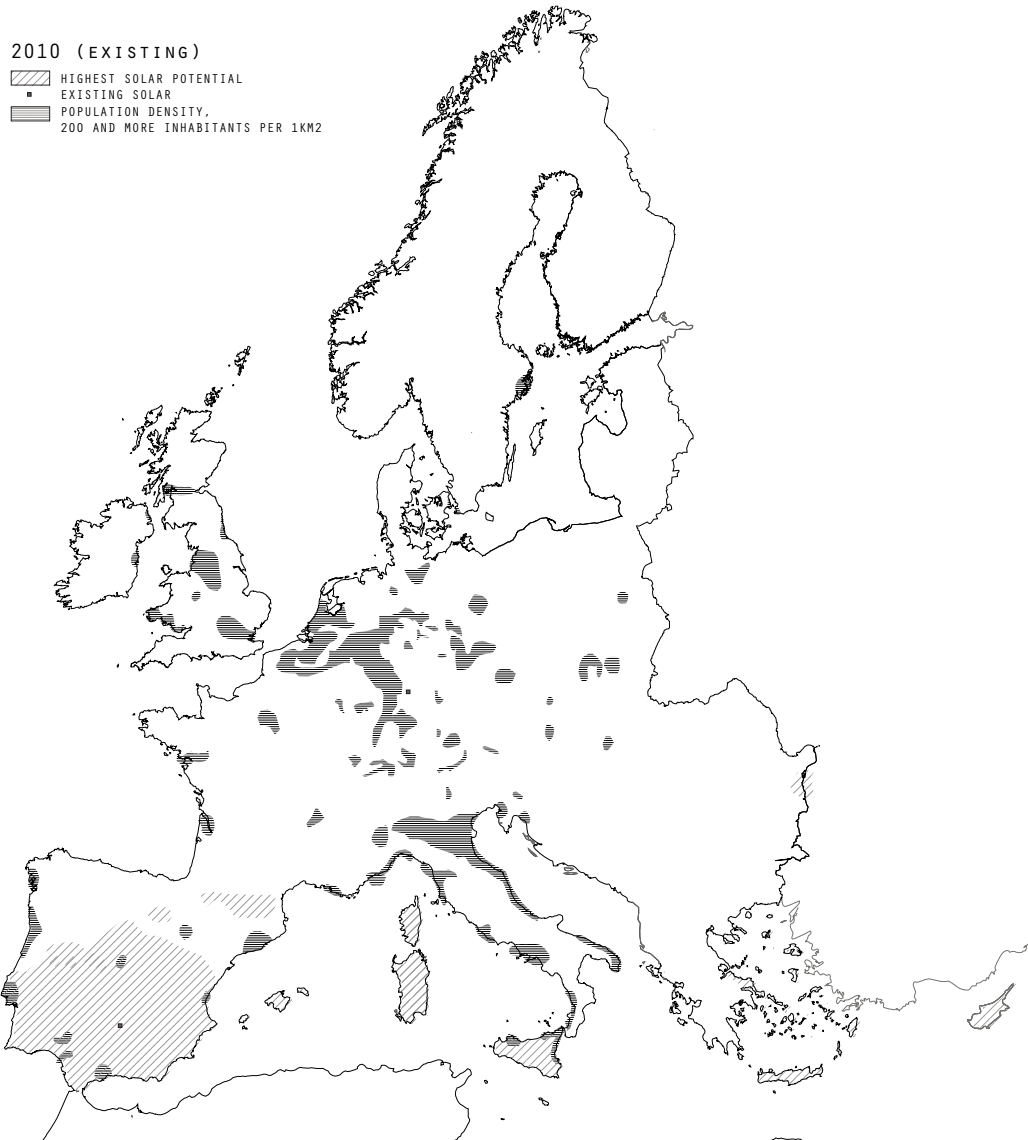
SOURCE: EU Energy and Transport in Figures  
 1) 3354 TWH/Year 2006 (Eurostat December 2008)  
 2) 3534 TWH/Year 2010 (Estimate)  
 3) Projected European demand in 2050 is 4900TWH/Year  
 4900 TWH/Year 2050 (Roadmap 2050 Technical Analysis)

# 80% PATHWAY \_ SOLAR




## PLAN FOR LOCATION OF SOLAR ENERGY PRODUCTION.

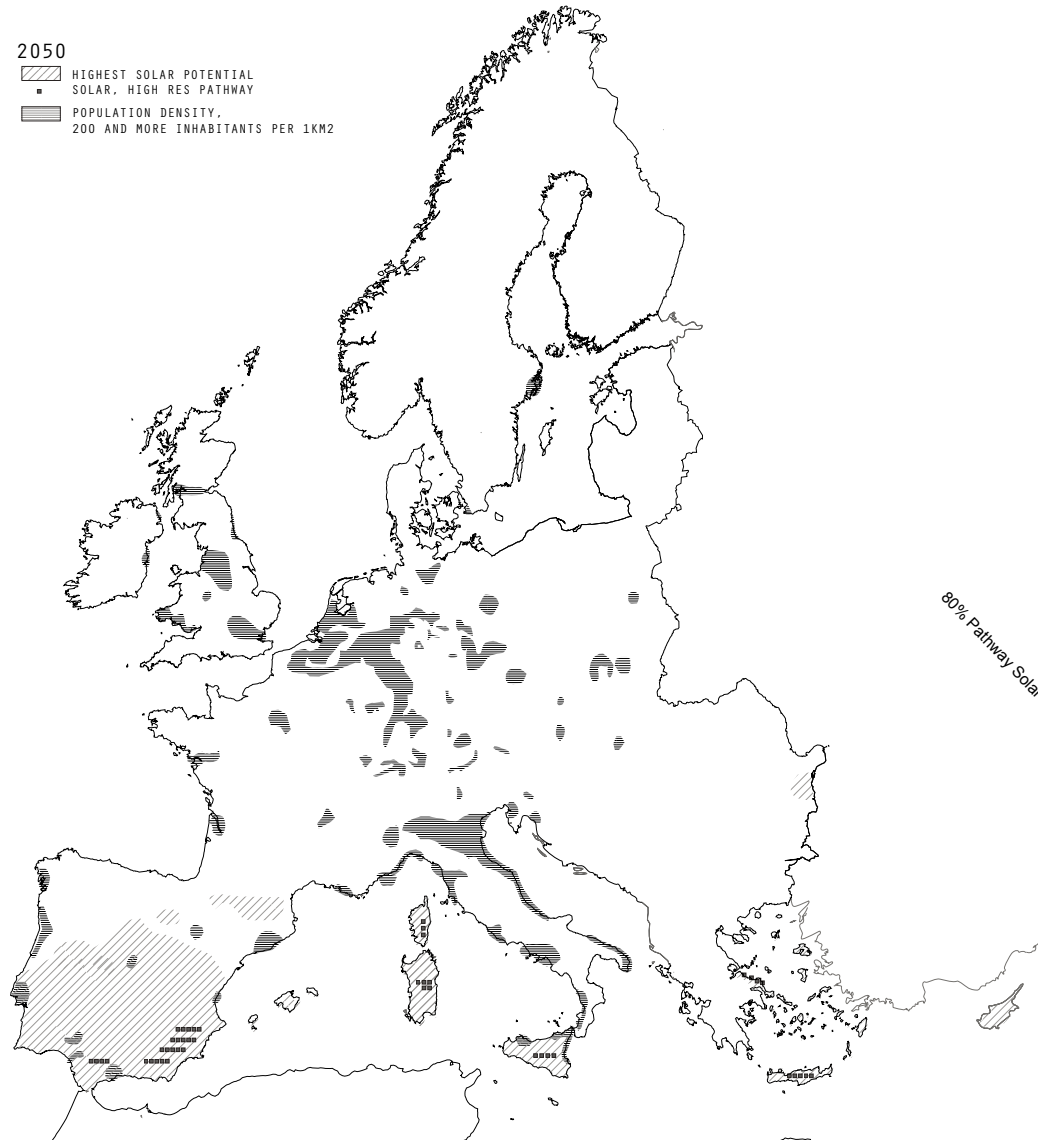
### 2010 (EXISTING)

-  HIGHEST SOLAR POTENTIAL
-  EXISTING SOLAR
-  POPULATION DENSITY, 200 AND MORE INHABITANTS PER 1KM2



### 2050

-  HIGHEST SOLAR POTENTIAL
-  SOLAR, HIGH RES PATHWAY
-  POPULATION DENSITY, 200 AND MORE INHABITANTS PER 1KM2



Note: The installation of about 5,000 square kilometers of solar panels over 40 years in the 60 percent RES pathway, equalling 0.1 percent of the area of the European Union (assuming 50% of these being rooftops solar panels). This requires significant project management efforts and (spatial) planning and permitting at large scale. The new installation and replacement of close to 100,000 wind turbines (of which half could be at sea), equaling 2,000 to 4,000 new wind turbines per year. This is about the same pace as the wind sector has built over the past decade, albeit that the new wind turbines are significantly larger (up to 7-10 MW), with a large share offshore in challenging conditions.

SOURCE: Roadmap 2050 Technical Analysis

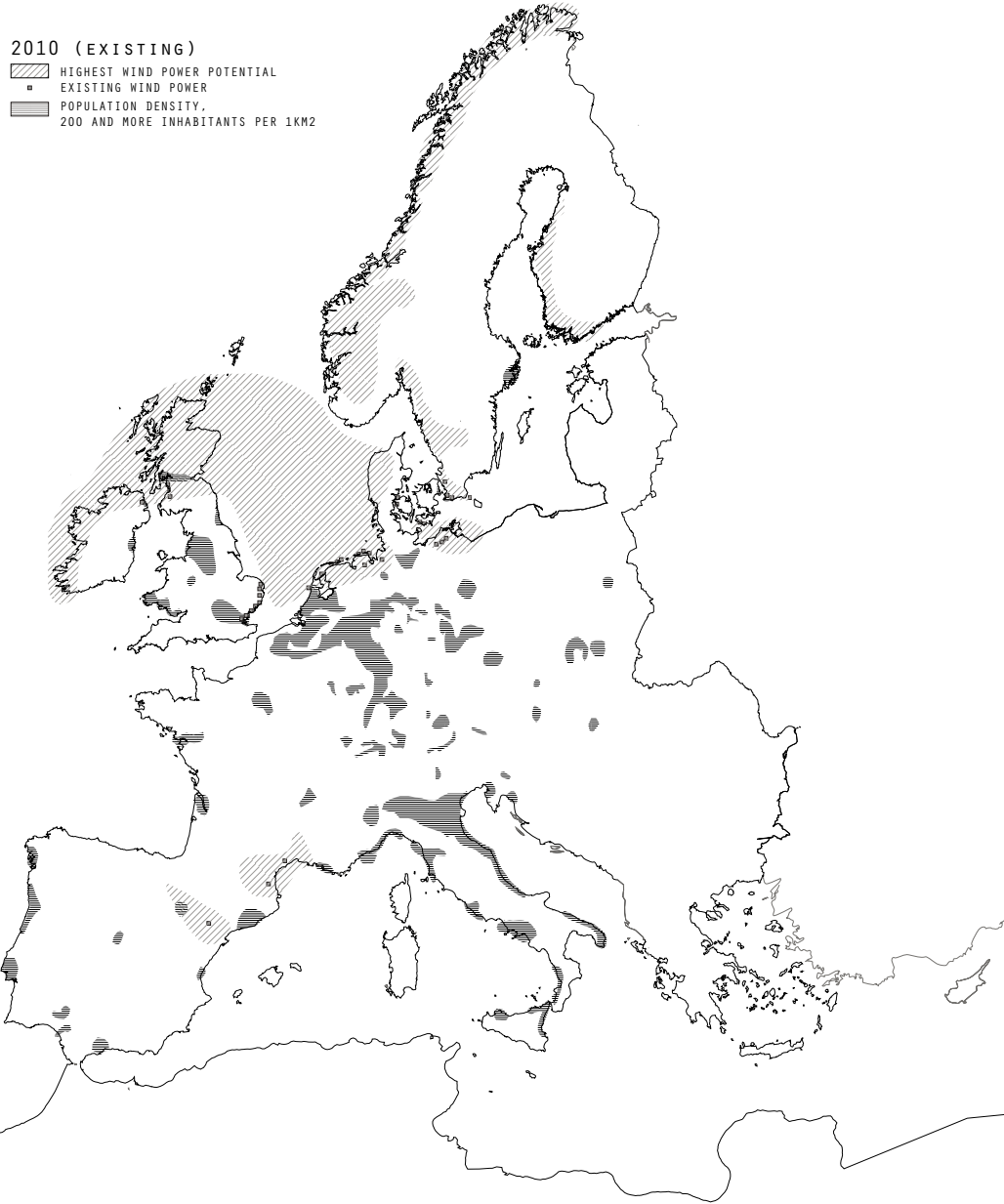
80% Pathway Solar

# 80% PATHWAY \_ WIND ENERGY

PLAN FOR LOCATION  
OF WIND ENERGY  
PRODUCTION.

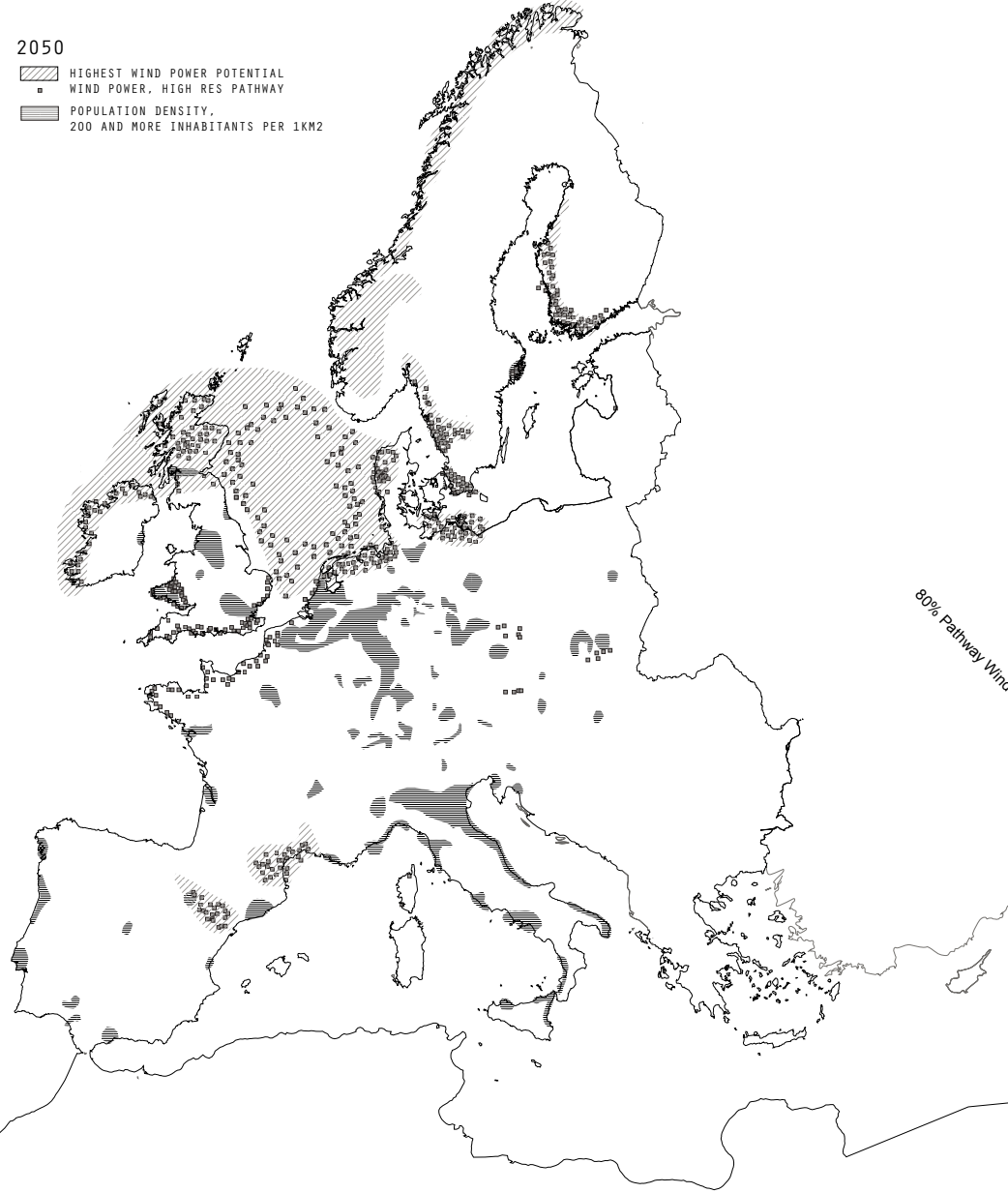
## 2010 (EXISTING)

- HIGHEST WIND POWER POTENTIAL
- EXISTING WIND POWER
- POPULATION DENSITY,  
200 AND MORE INHABITANTS PER 1KM2



## 2050

- HIGHEST WIND POWER POTENTIAL  
WIND POWER, HIGH RES PATHWAY
- POPULATION DENSITY,  
200 AND MORE INHABITANTS PER 1KM2



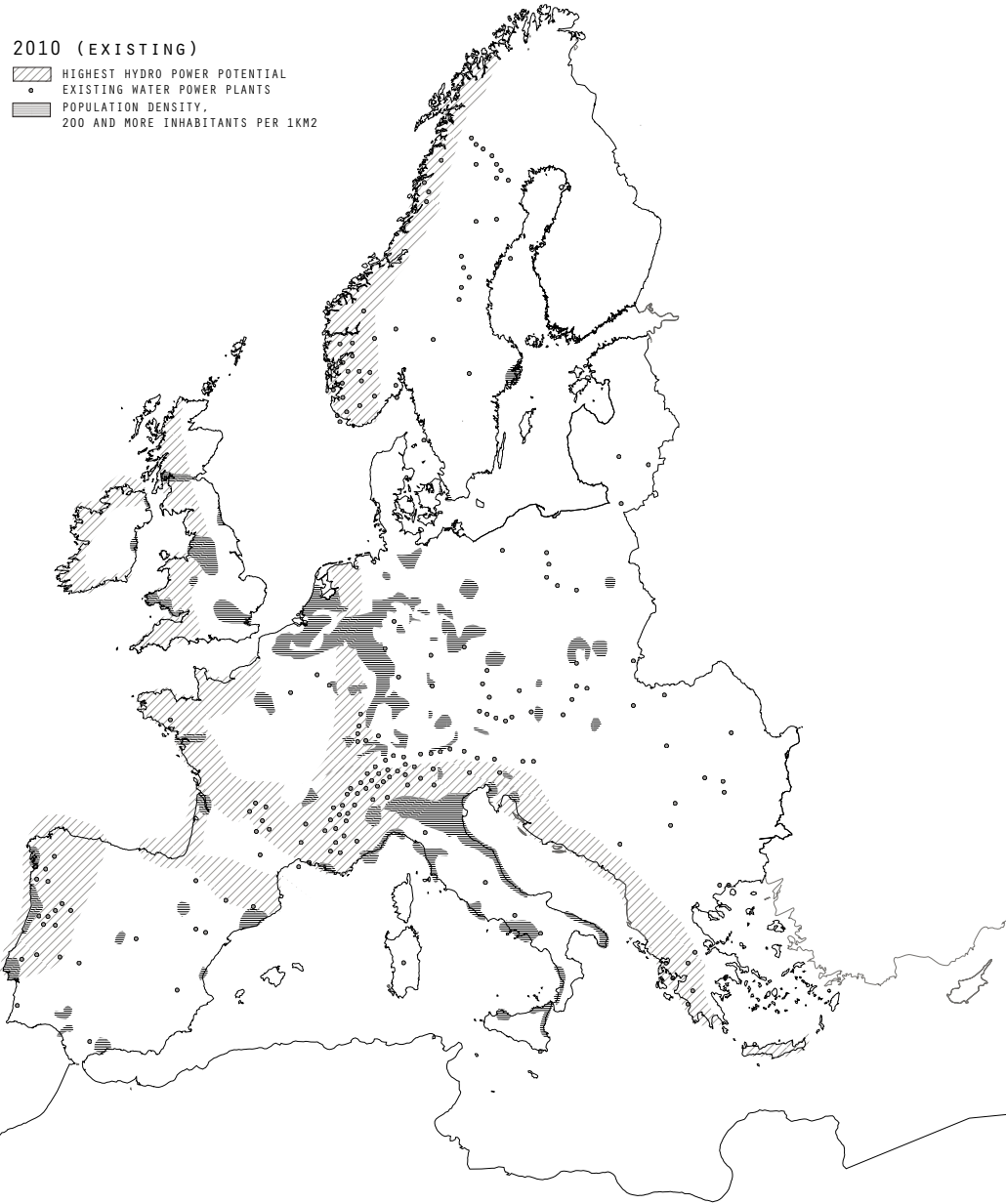
80% Pathway Wind

# 80% PATHWAY \_ HYDRO

PLAN FOR LOCATION  
OF HYDROELECTRIC  
ENERGY PRODUCTION.

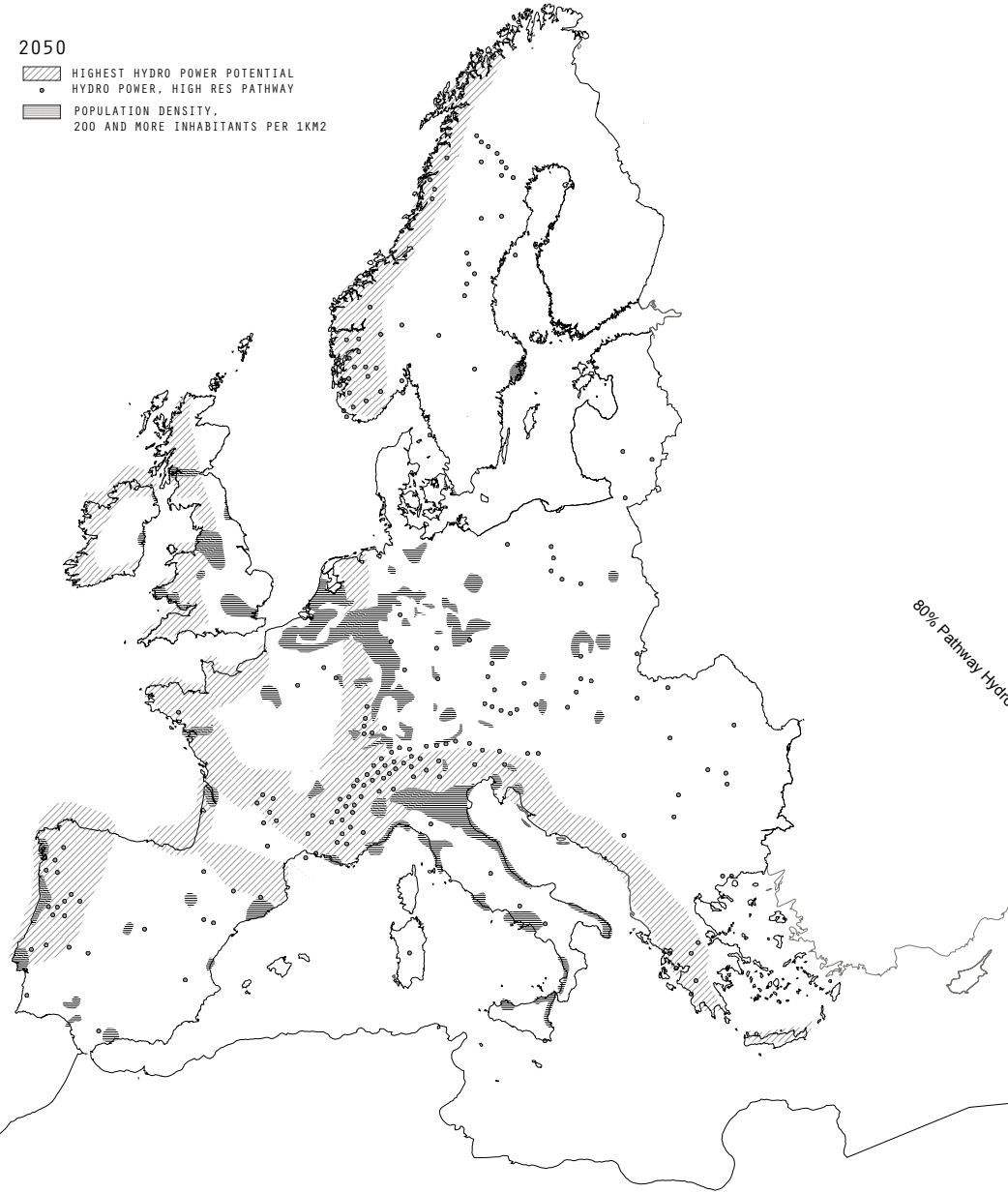
## 2010 (EXISTING)

- HIGHEST HYDRO POWER POTENTIAL
- EXISTING WATER POWER PLANTS
- POPULATION DENSITY,  
200 AND MORE INHABITANTS PER 1KM2



## 2050

- HIGHEST HYDRO POWER POTENTIAL  
HYDRO POWER, HIGH RES PATHWAY
- POPULATION DENSITY,  
200 AND MORE INHABITANTS PER 1KM2






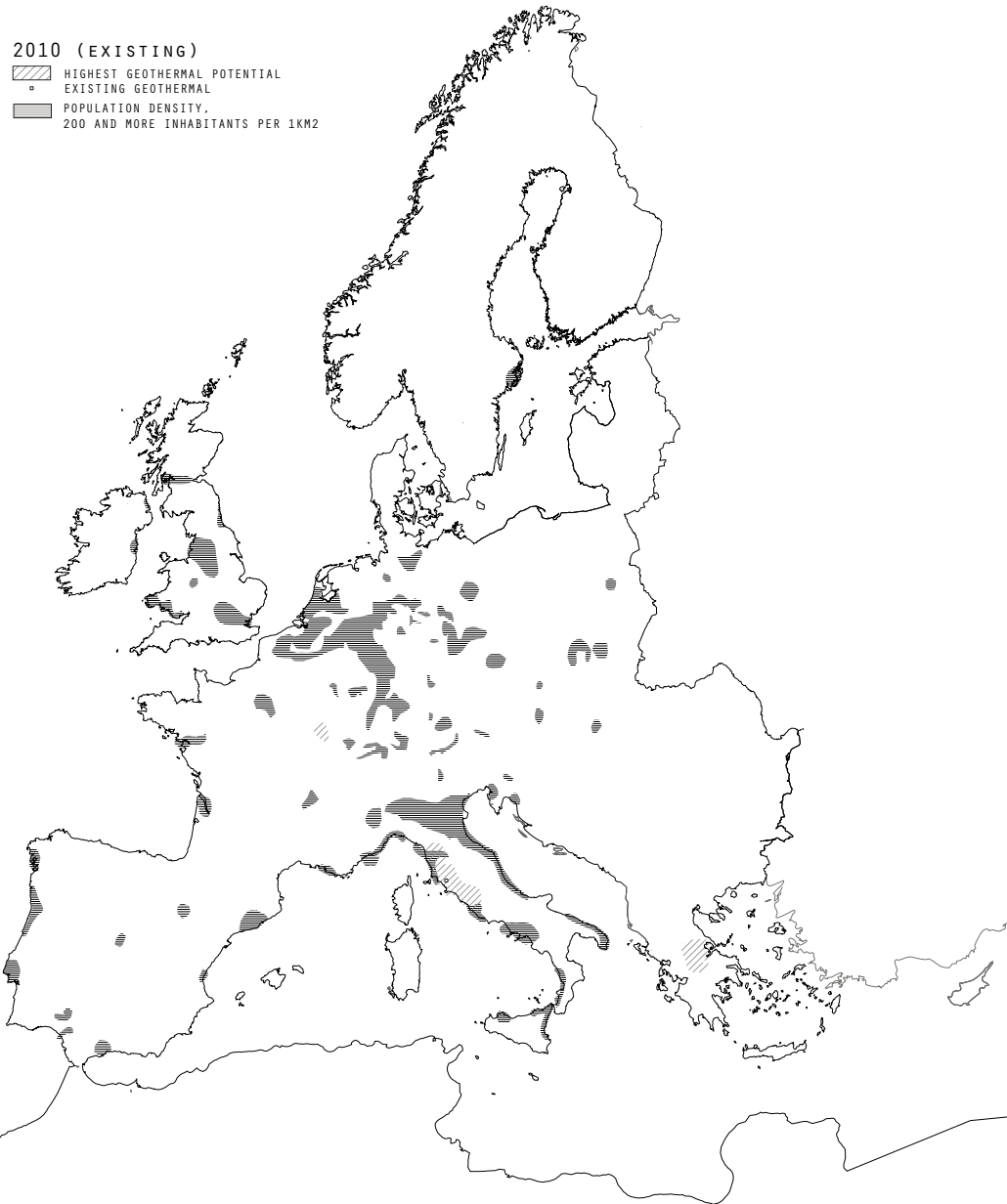
80% Pathway Hydro

# 80% PATHWAY \_ GEOTHERMAL




PLAN FOR LOCATION  
OF GEOTHERMAL  
ENERGY PRODUCTION.

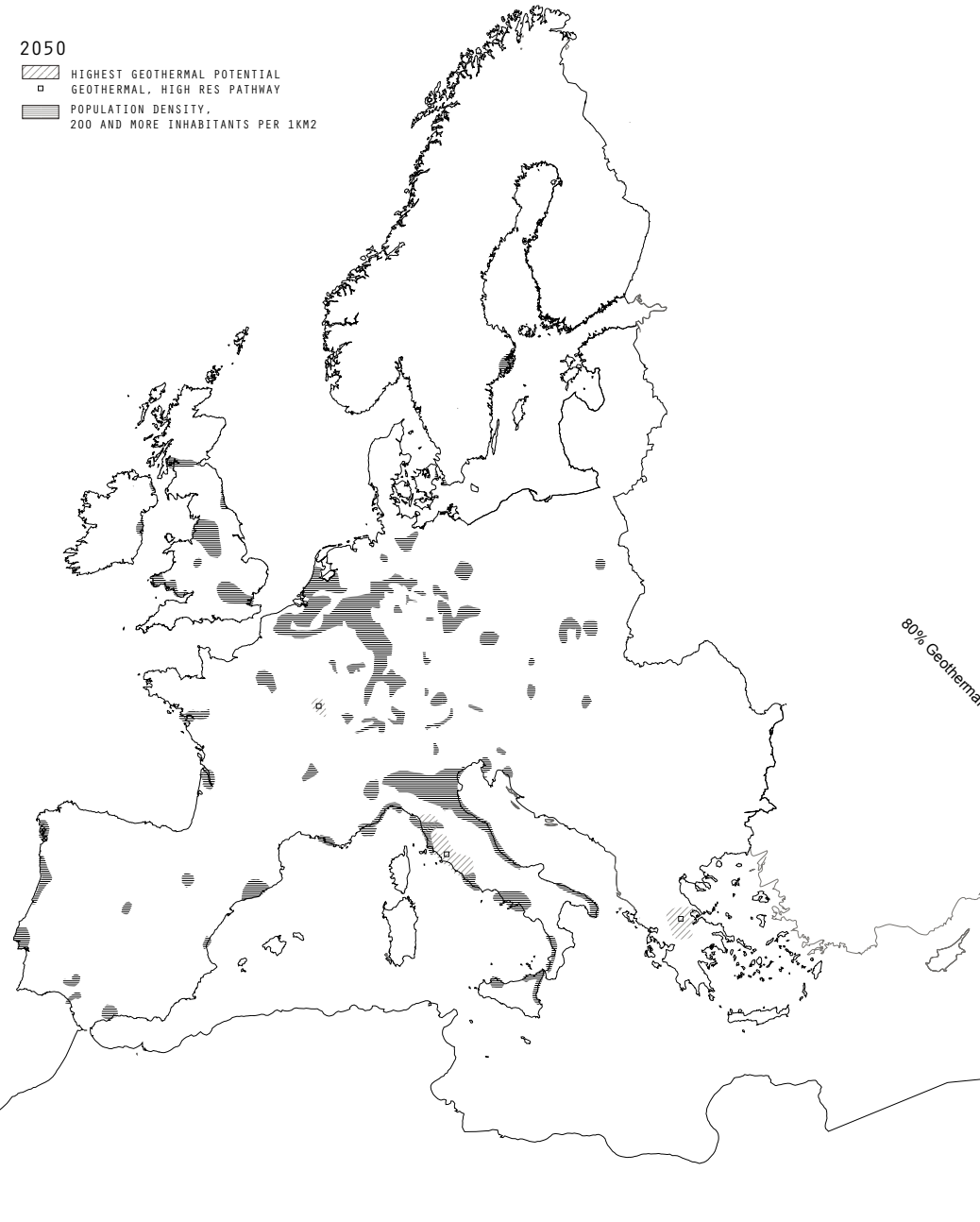
## 2010 (EXISTING)

-  HIGHEST GEOTHERMAL POTENTIAL
-  EXISTING GEOTHERMAL
-  POPULATION DENSITY,  
200 AND MORE INHABITANTS PER 1KM2



## 2050

-  HIGHEST GEOTHERMAL POTENTIAL
-  GEOTHERMAL, HIGH RES PATHWAY
-  POPULATION DENSITY,  
200 AND MORE INHABITANTS PER 1KM2



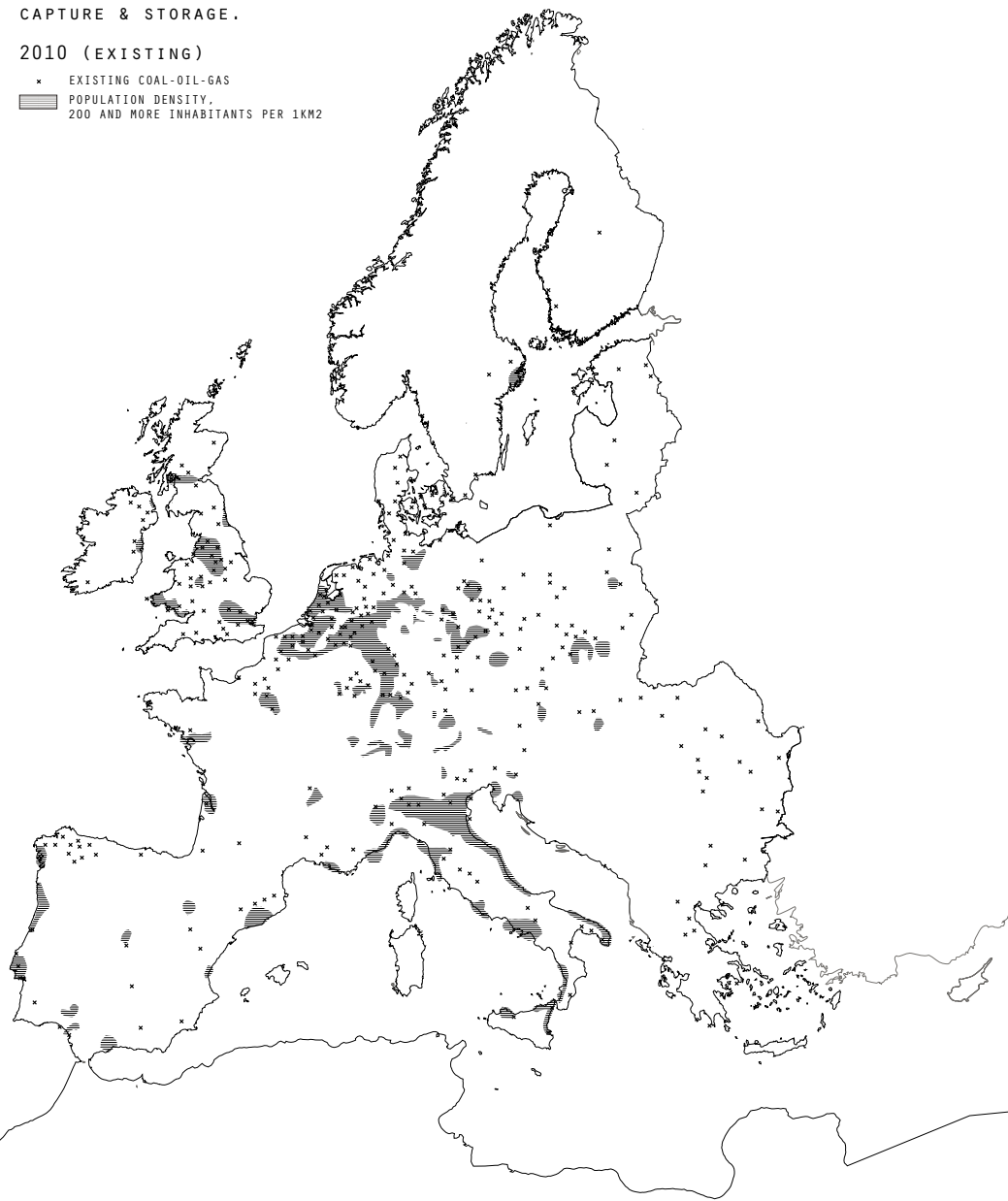
80% Geothermal

# 80% PATHWAY \_ COAL/GAS/PETROLEUM

PLAN FOR LOCATION  
OF COAL/GAS/OIL  
ENERGY PRODUCTION.  
IN 2050, THE AMOUNT  
OF COAL/GAS/  
PETROLEUM POWER  
IS REDUCED AND  
INCLUDES CARBON  
CAPTURE & STORAGE.

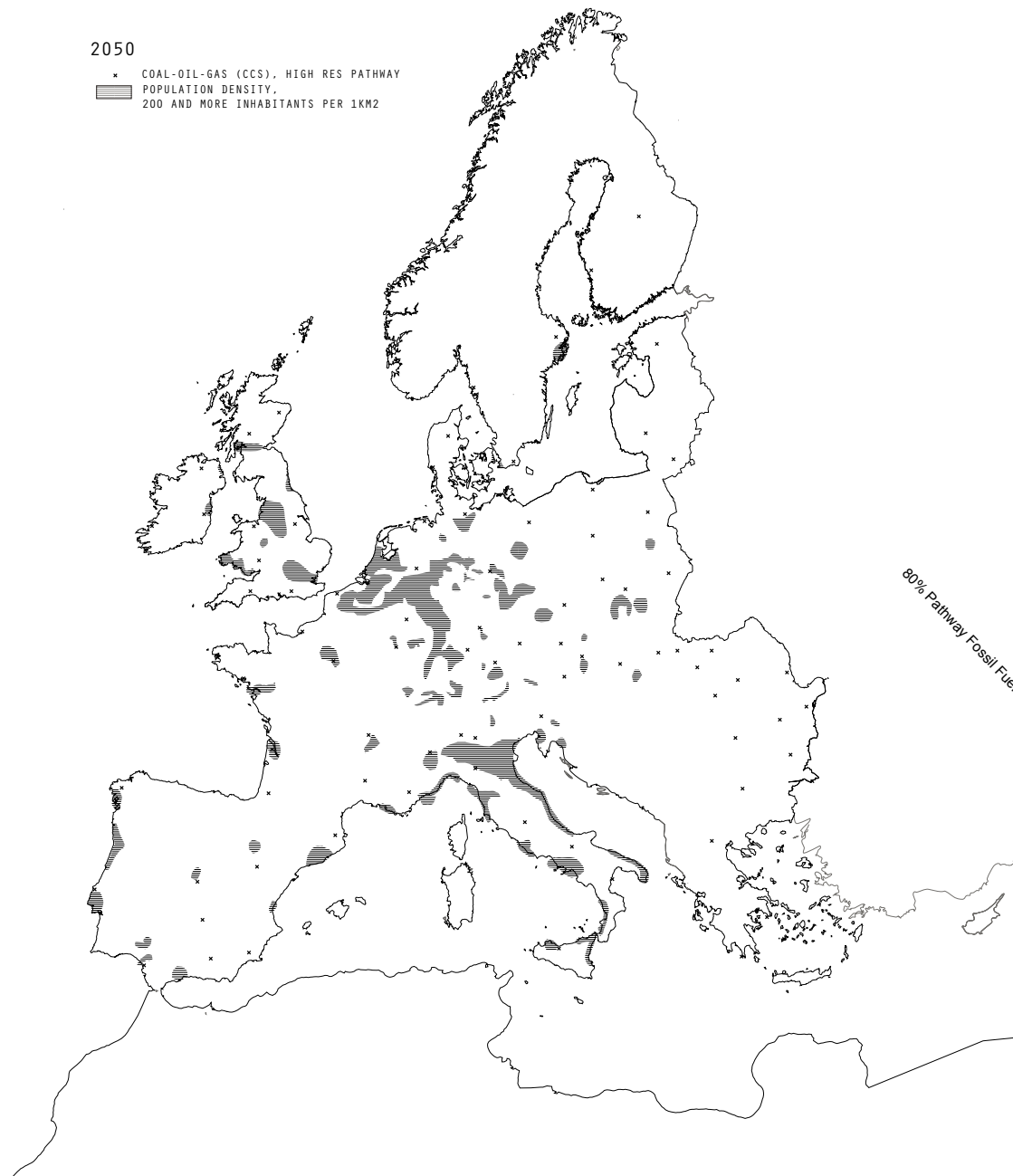
2010 (EXISTING)

\* EXISTING COAL-OIL-GAS  
POPULATION DENSITY,  
200 AND MORE INHABITANTS PER 1KM2



2050

\* COAL-OIL-GAS (CCS), HIGH RES PATHWAY  
POPULATION DENSITY,  
200 AND MORE INHABITANTS PER 1KM2



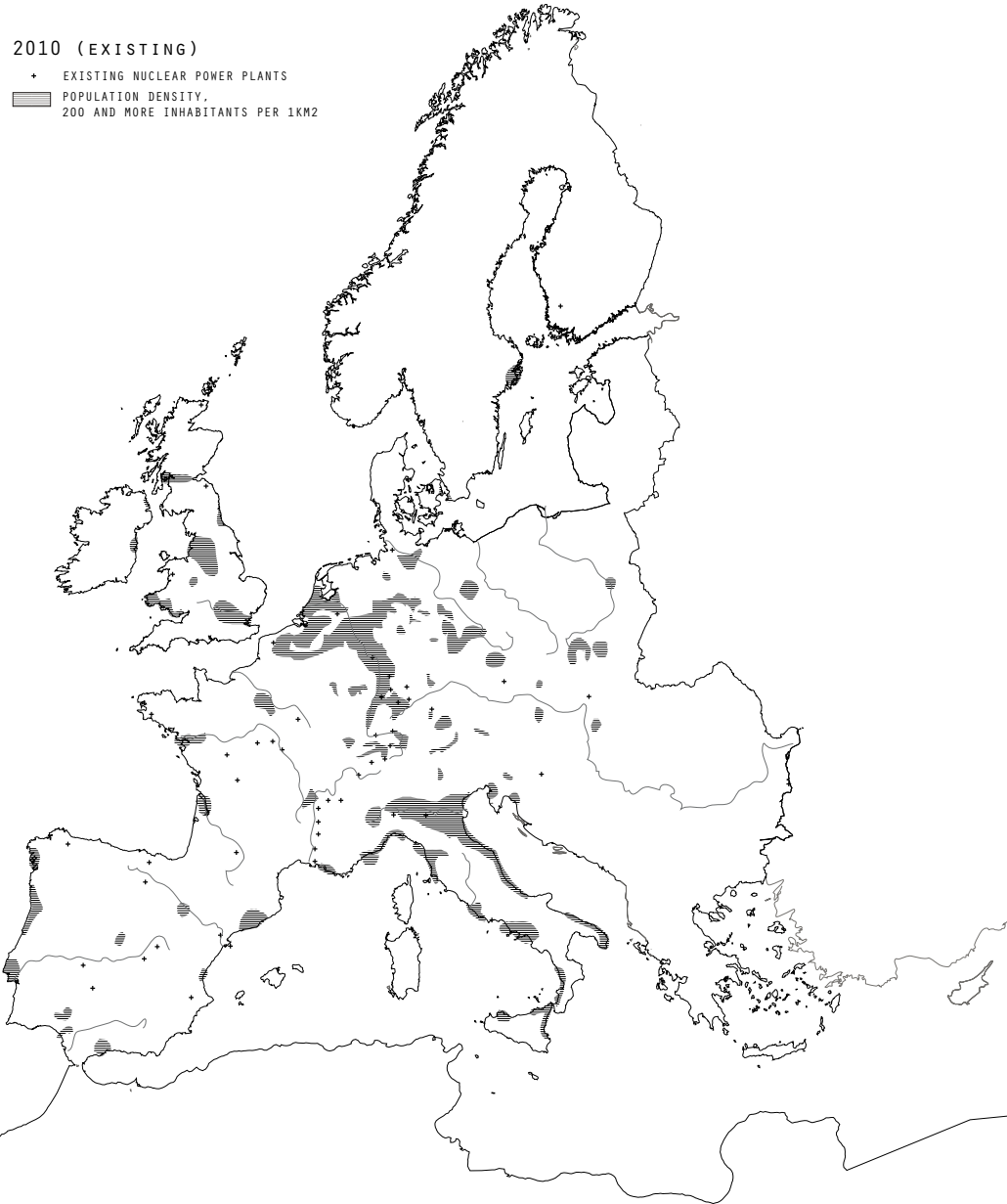
80% Pathway Fossil Fuel

# 80% PATHWAY \_ NUCLEAR

PLAN FOR LOCATION  
OF NUCLEAR ENERGY  
PRODUCTION. IN  
2050, THE AMOUNT OF  
NUCLEAR POWER IS  
REDUCED.

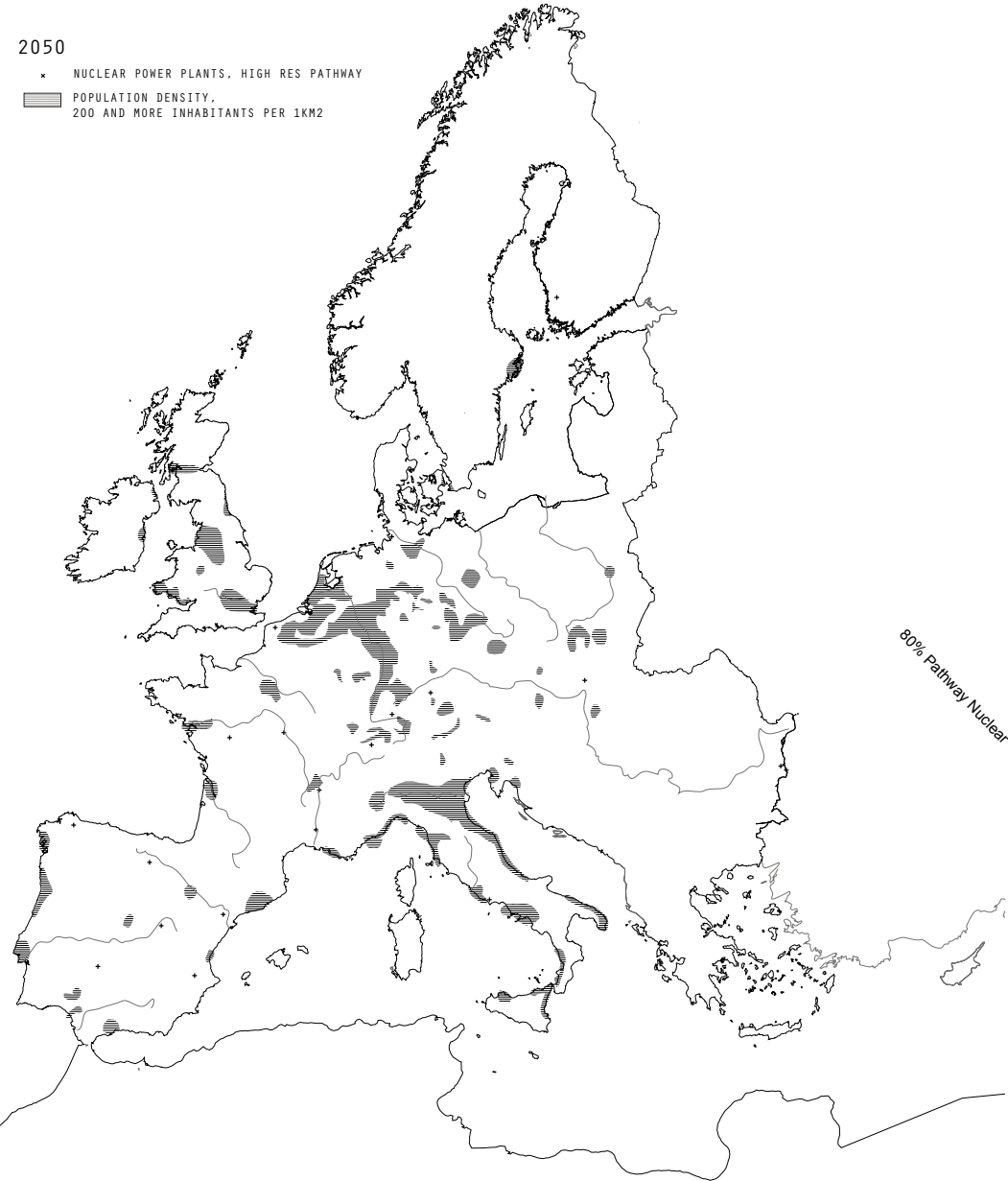
## 2010 (EXISTING)

- + EXISTING NUCLEAR POWER PLANTS
- ▨ POPULATION DENSITY,  
200 AND MORE INHABITANTS PER 1KM2



## 2050

- \* NUCLEAR POWER PLANTS, HIGH RES PATHWAY
- ▨ POPULATION DENSITY,  
200 AND MORE INHABITANTS PER 1KM2



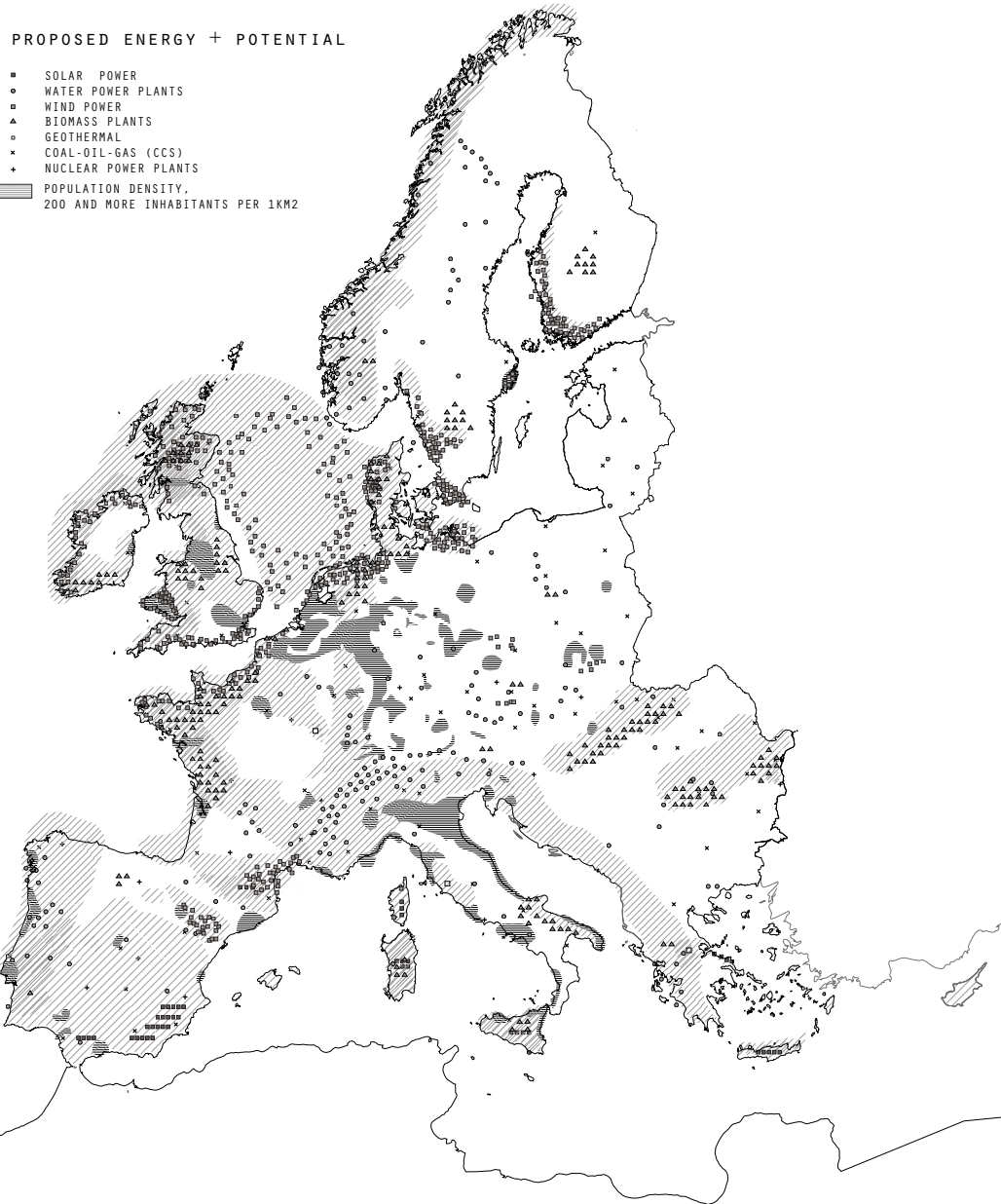
80% Pathway Nuclear

# COMBINED ENERGY TYPES \_ 80% PATHWAY

EXISTING ENERGY  
 POTENTIAL LOCATION  
 OF PROPOSED ENERGY  
 TYPES FOR 80%  
 PATHWAY.

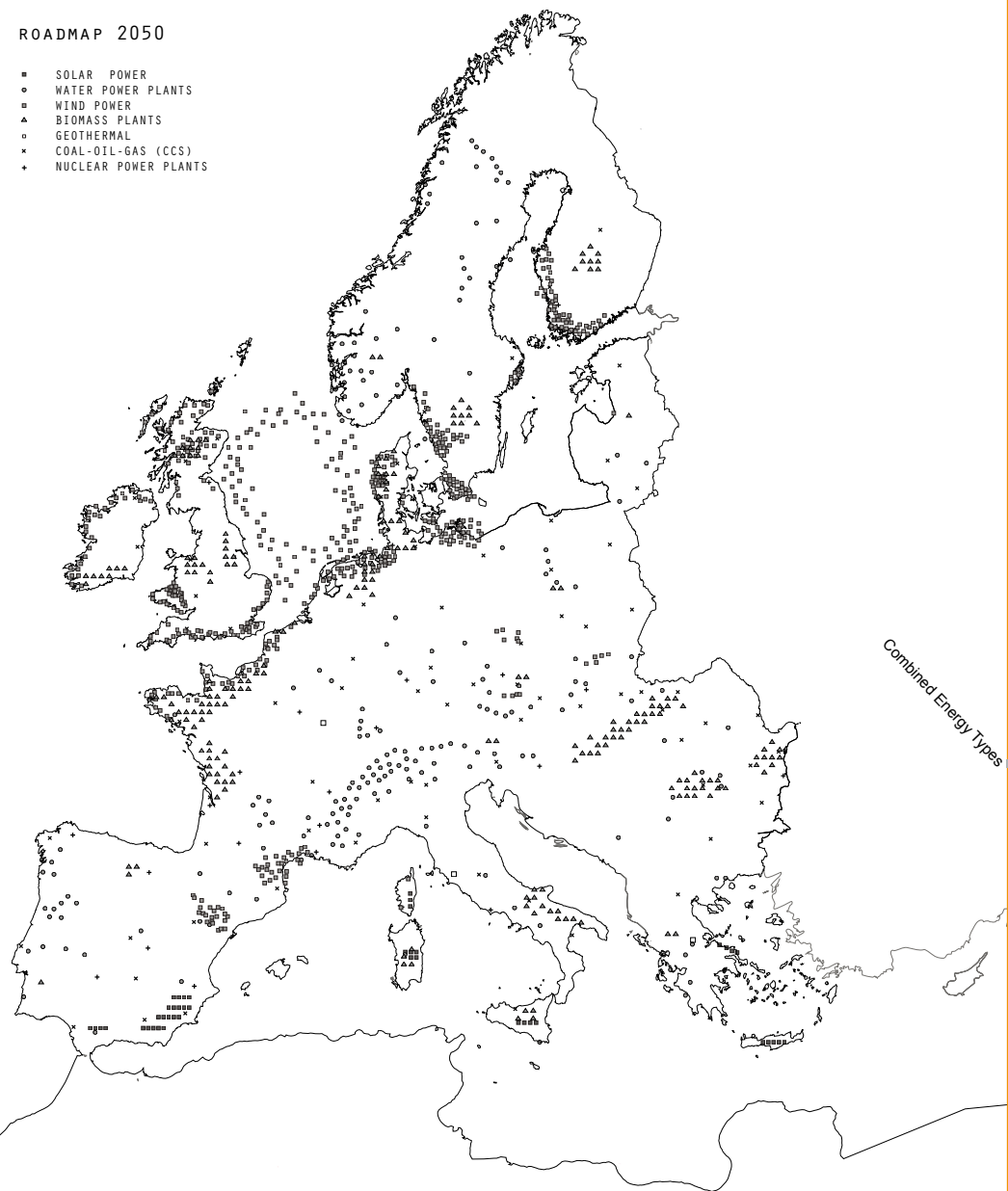
## PROPOSED ENERGY + POTENTIAL

- SOLAR POWER
- WATER POWER PLANTS
- WIND POWER
- ▲ BIOMASS PLANTS
- GEOTHERMAL
- × COAL-OIL-GAS (CCS)
- NUCLEAR POWER PLANTS
- ▨ POPULATION DENSITY,  
200 AND MORE INHABITANTS PER 1KM2



## ROADMAP 2050

- SOLAR POWER
- WATER POWER PLANTS
- WIND POWER
- ▲ BIOMASS PLANTS
- GEOTHERMAL
- × COAL-OIL-GAS (CCS)
- NUCLEAR POWER PLANTS



Combined Energy Types

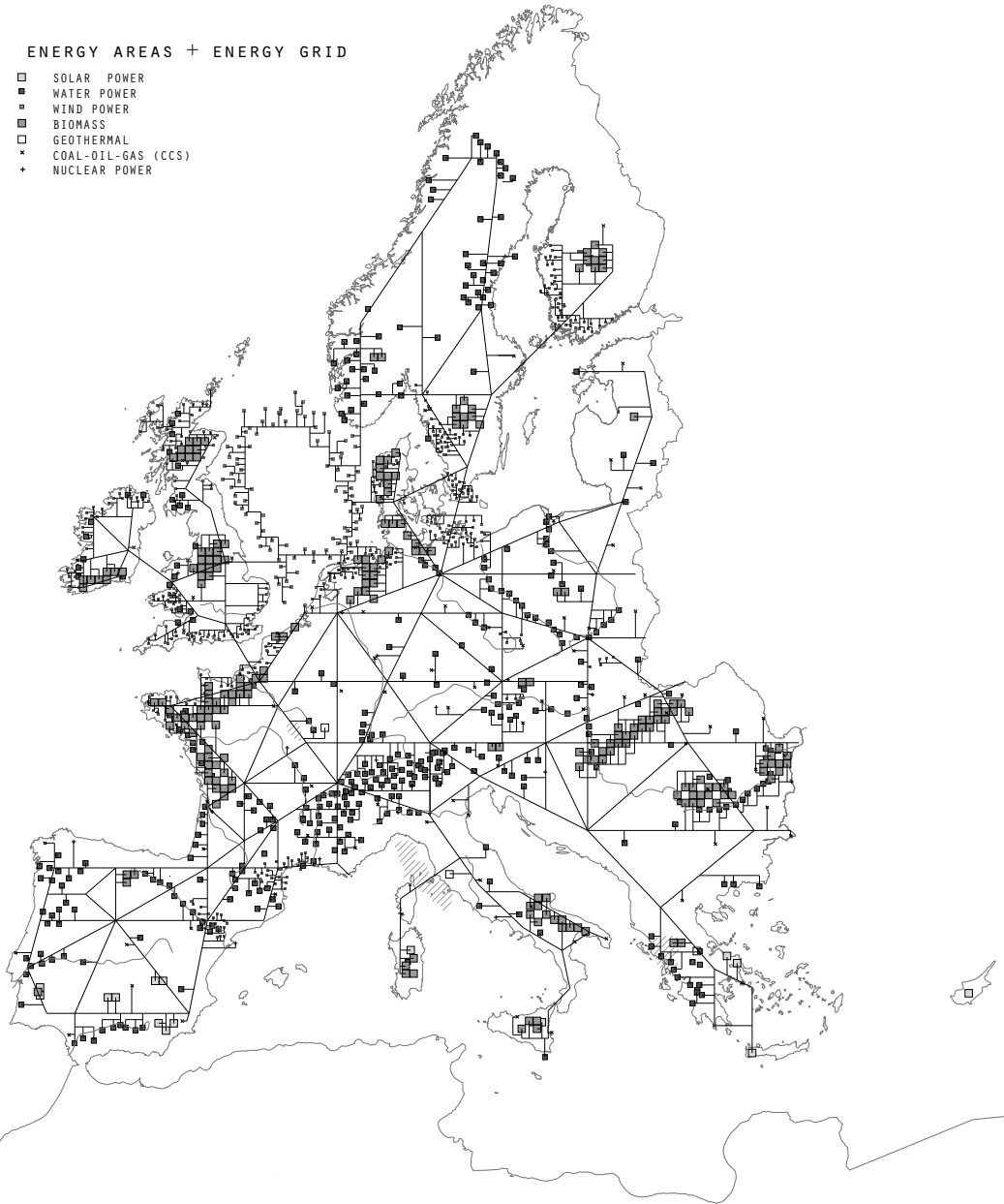


# 2050 ENERGY GRID \_ 80% PATHWAY

NEW ENERGY GRID FOR  
THE 80% RENEWABLE  
ENERGY PATHWAY.

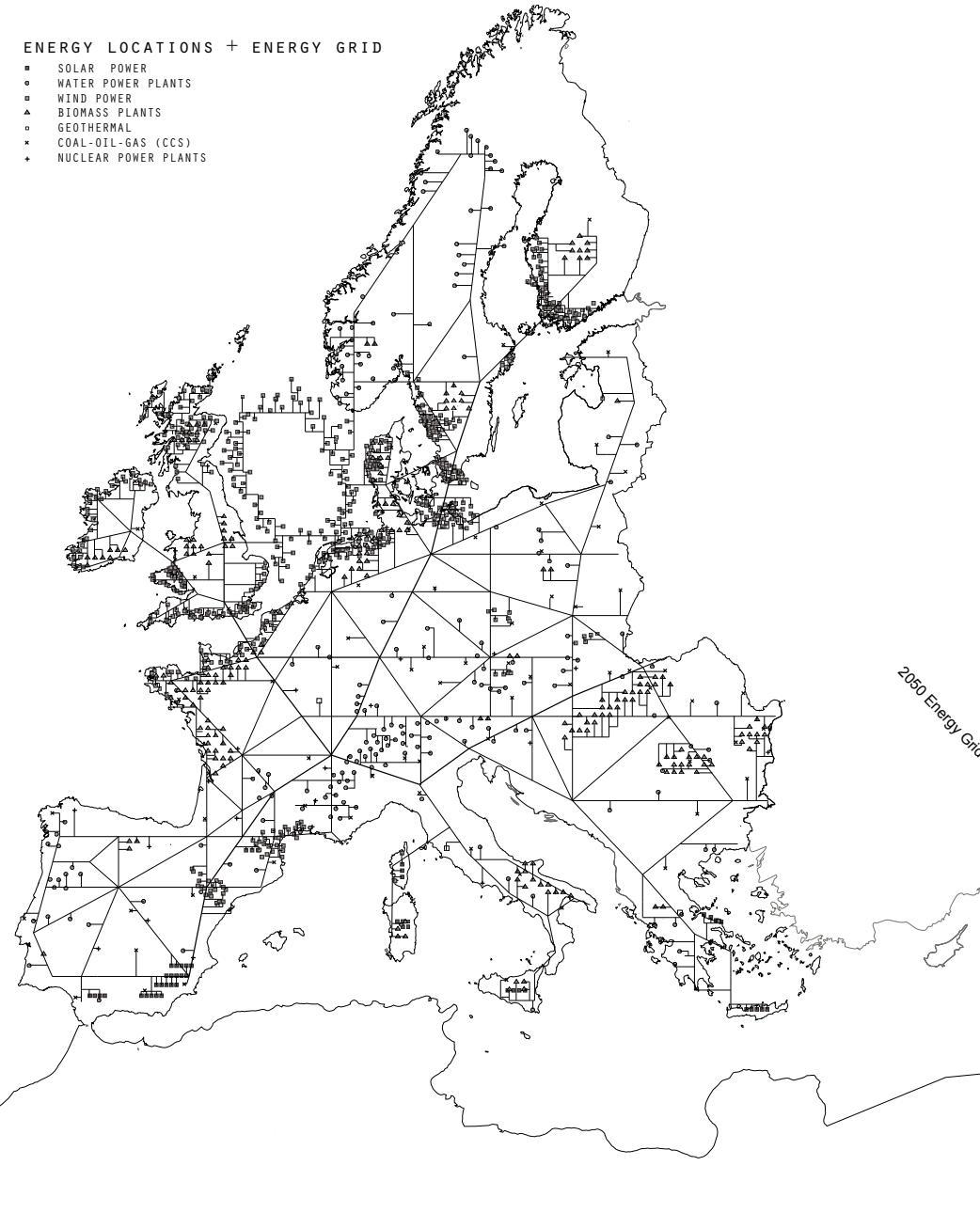
## ENERGY AREAS + ENERGY GRID

- SOLAR POWER
- WATER POWER
- ▣ WIND POWER
- ▢ BIOMASS
- GEOTHERMAL
- \* COAL-OIL-GAS (CCS)
- NUCLEAR POWER



## ENERGY LOCATIONS + ENERGY GRID

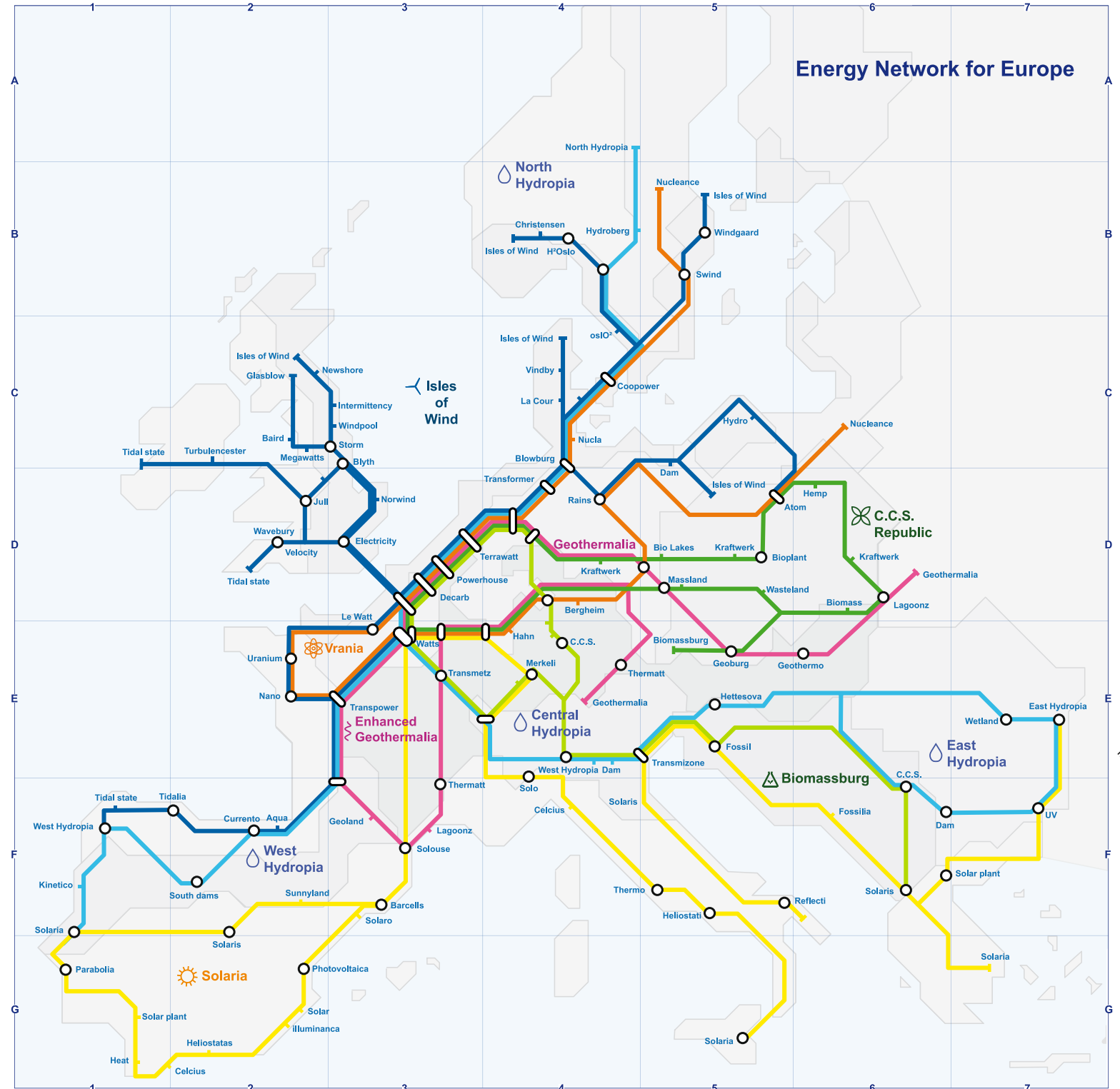
- SOLAR POWER
- WATER POWER PLANTS
- WIND POWER
- ▲ BIOMASS PLANTS
- GEOTHERMAL
- \* COAL-OIL-GAS (CCS)
- NUCLEAR POWER PLANTS



2050 Energy Grid

# EU ENERGY NETWORK

DIAGRAMMATIC REPRESENTATION OF INTEGRATED EUROPEAN POWER GRID.



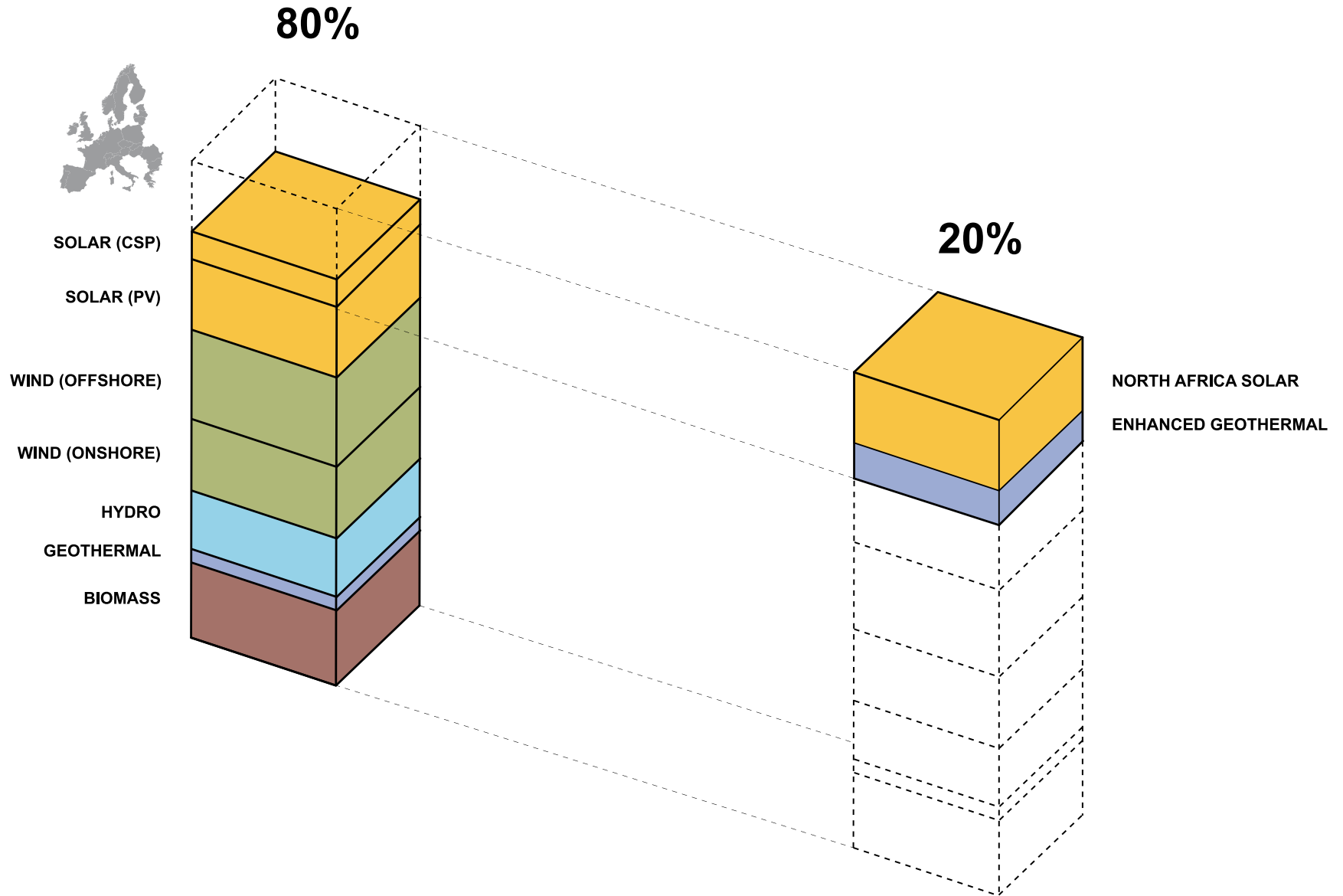
## Key to Lines

- | Interchange station | Power station |             |
|---------------------|---------------|-------------|
|                     |               | Hydropower  |
|                     |               | Wind Power  |
|                     |               | Geothermal  |
|                     |               | Nuclear     |
|                     |               | Solar Power |
|                     |               | C.C.S.      |
|                     |               | Biomass     |

Metro Map

# 100% PATHWAY

ADDITIONAL CAPACITY IS REQUIRED TO REACH THE 100% RENEWABLE ENERGY PATHWAY THIS IS ACHIEVED THROUGH THE INTRODUCTION OF BREAKTHROUGH TECHNOLOGIES + SOLAR FROM N. AFRICA

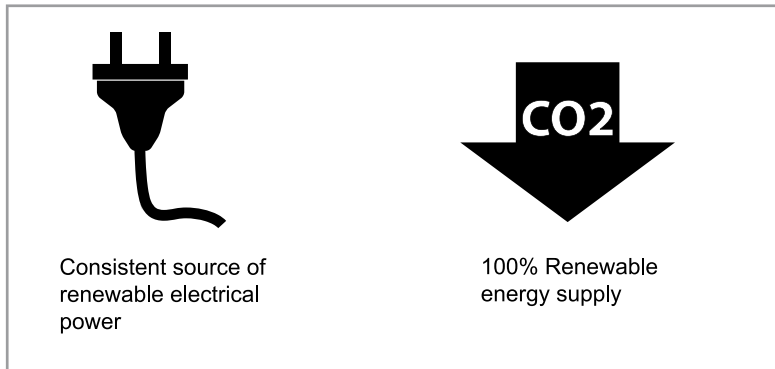


SOURCE: Roadmap 2050 Technical Analysis, Desertec

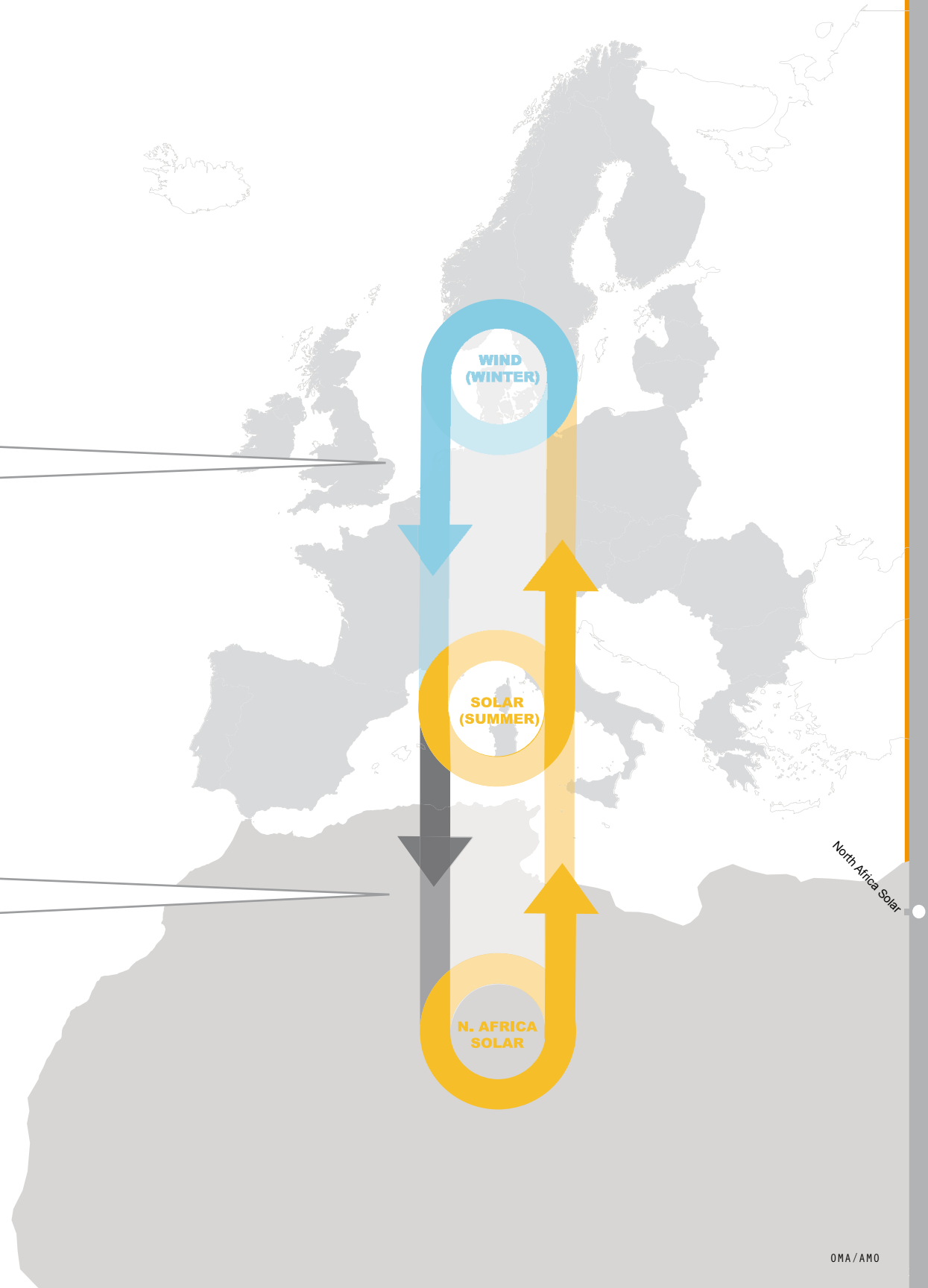
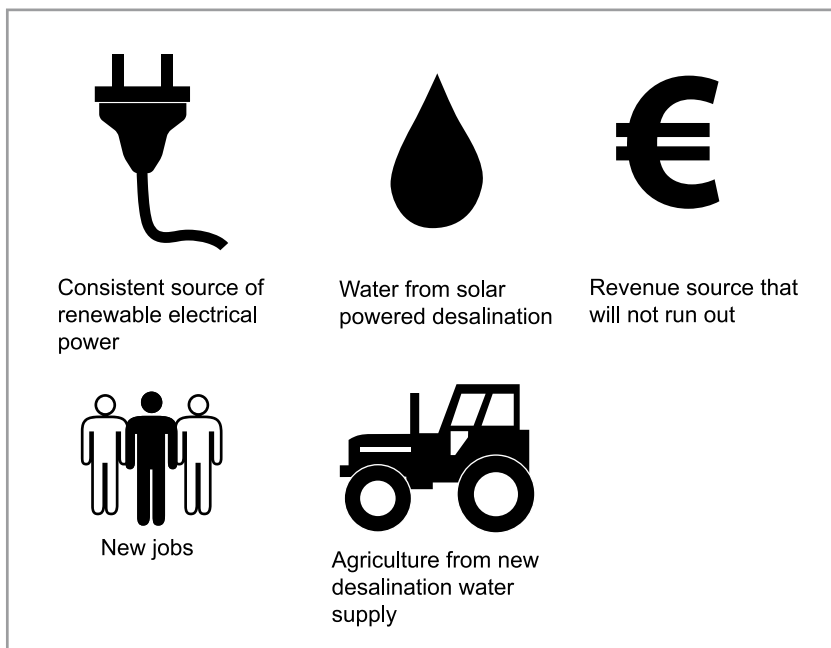
# BENEFITS OF NORTH AFRICAN SOLAR

BOTH THE EU-27 AND NORTH AFRICA WILL BENEFIT FROM THEIR INTRODUCTION INTO THE EUROPEAN ENERGY GRID.

## EU-27:

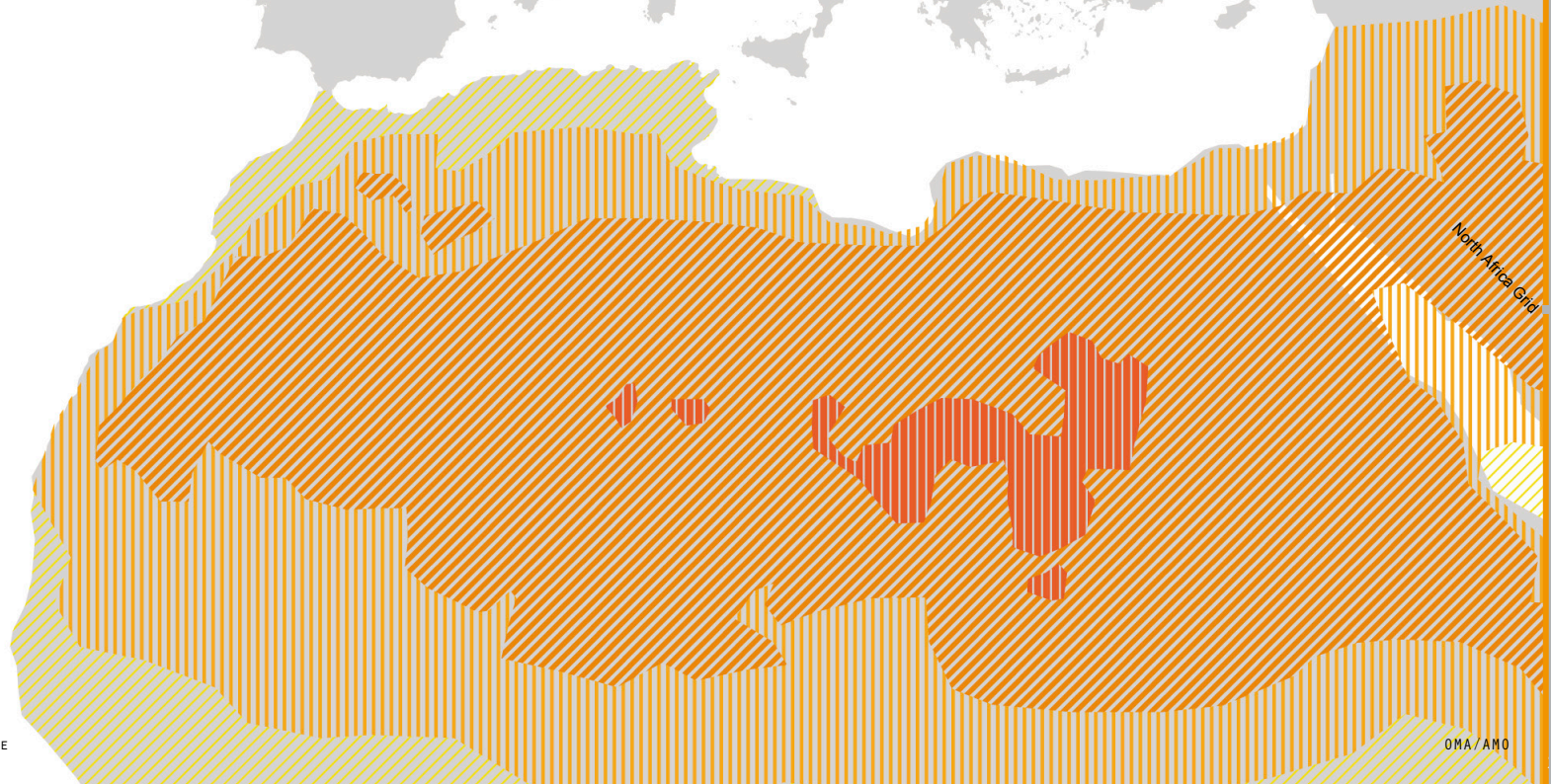
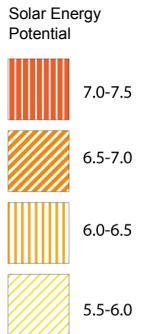
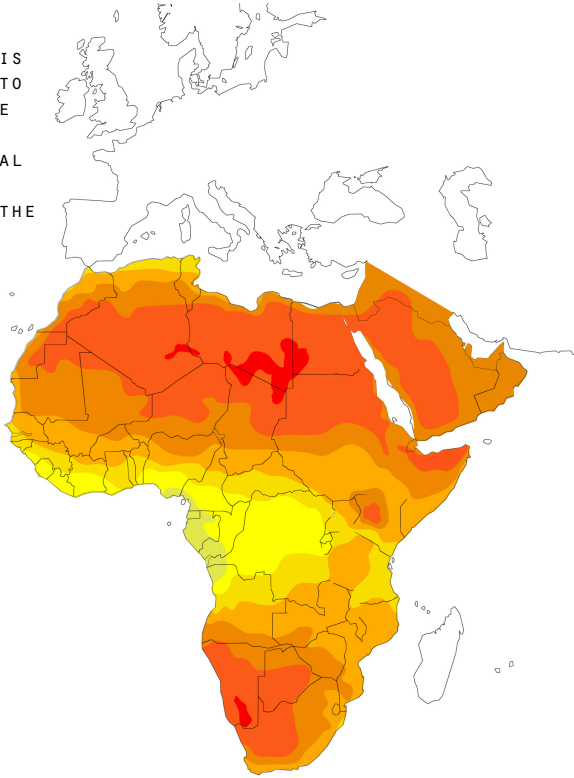
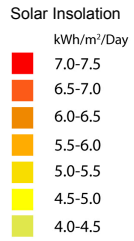


## NORTH AFRICA:



# NORTH AFRICA SOLAR ENERGY POTENTIAL

NORTH AFRICA IS WELL LOCATED TO TAKE ADVANTAGE OF THE HIGH SOLAR POTENTIAL AND RELATIVE PROXIMITY TO THE EU-27.



# EU- ENERGY GRID

INCLUDING NORTH  
AFRICA IN THE  
EUROPEAN ENERGY  
GRID INCREASES  
CAPACITY.

- SOLAR POWER
- WATER POWER PLANTS
- ▣ WIND POWER
- ▲ BIOMASS PLANTS
- ◻ GEOTHERMAL
- × COAL-OIL-GAS (CCS)
- + NUCLEAR POWER PLANTS

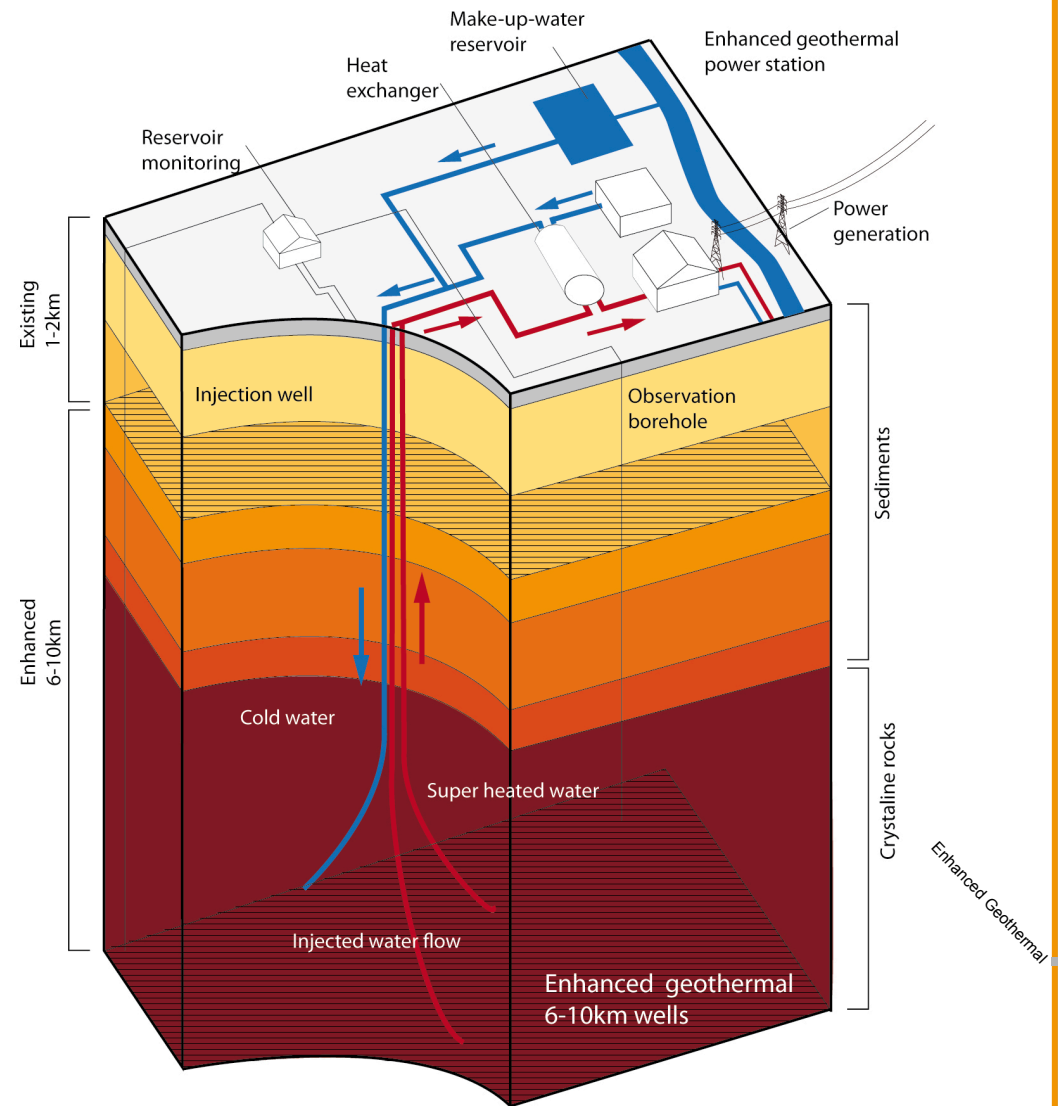
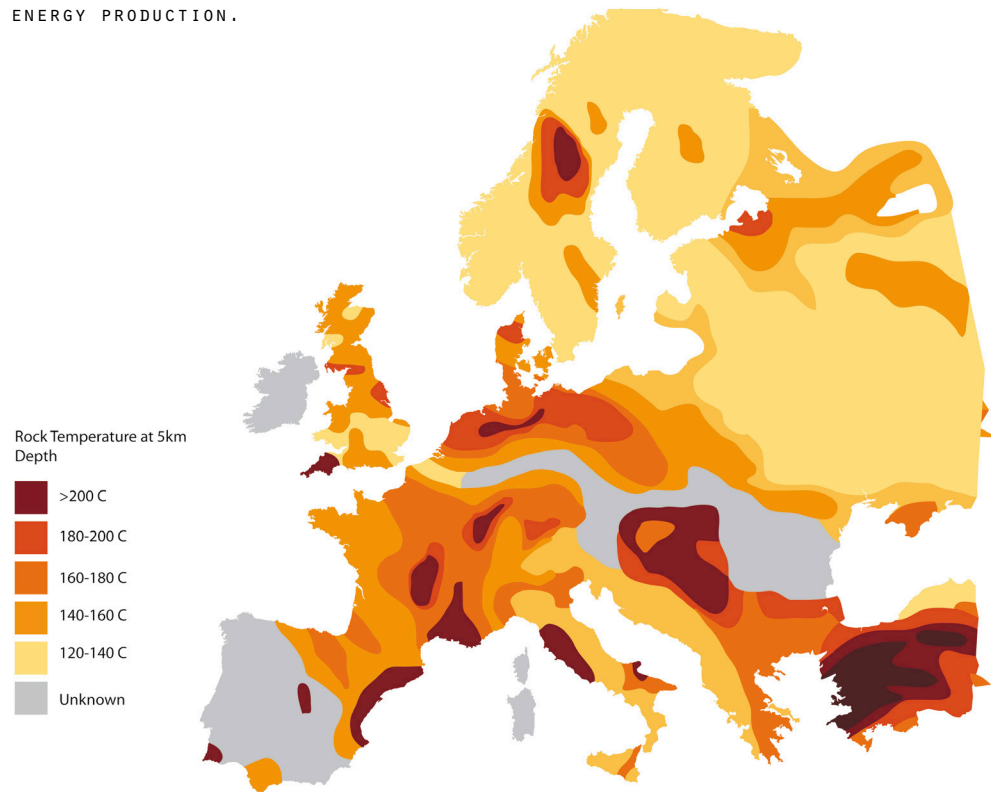




EU North Africa Link

# BREAKTHROUGH TECHNOLOGY: ENHANCED GEOTHERMAL

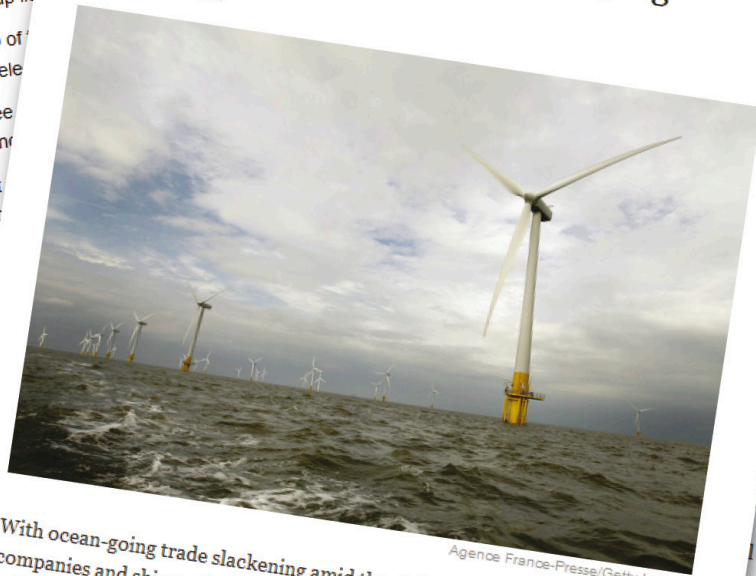
THE ADDITION OF 5% GEOTHERMAL FOR THE 100% RENEWABLE ENERGY BUDGET REQUIRES THE IMPLEMENTATION OF ENHANCED GEOTHERMAL TECHNIQUES. WHERE GEOTHERMAL ENERGY IS USUALLY RELEGATED TO VOLCANICALLY ACTIVE REGIONS AND 1-2KM BOREHOLES, ENHANCED GEOTHERMAL USES 6-10KM DEEP BOREHOLES, PROVIDING A MUCH BROADER AREA TO TAP GEOTHERMAL HEAT FOR PRIMARY ENERGY PRODUCTION.





# Offshore Wind a Boon to the Shipping Industry

By LARS KROLDRUP



Agence France-Presse/Getty Images

With ocean-going trade slackening amid the global recession, shipping companies and shipyard operators in Europe are finding the offshore wind industry to be a welcome ally in weathering the bad times.

In a deal struck earlier this month, for example, the shipping giant **Maersk** has agreed to lease about 100,000 square meters of its Lindo shipping facility on the Danish island of Funen — about 10 percent of the total area of the shipyard — to **Skykon Offshore**, a maker of wind turbines.

## Britain launches 'green homes' loan scheme

Published: 03 March 2010

British households will be able to take out soft loans to improve the efficiency of their homes under a proposed new law to fight climate change and cut fuel poverty, the government said on Tuesday (2 March).

The aim is to overcome the high upfront cost of home refurbishments, for example to insulate lofts, thicken walls and install draught-proof windows, by allowing people to take out long-term loans at subsidised interest rates.

The cash-strapped British government hopes high demand will entice private sector lenders including banks, energy companies and low-carbon technology installers to supply loans at low rates of interest.

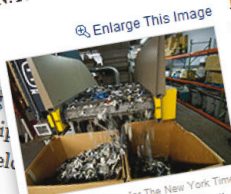
The plan depends on new legislation to tie new loans to a house rather than a person, allowing residents to move house independently of whether they have re-paid the debt or not.

"By spreading the repayments over a much longer period - more like 25 years than the eight years that someone might want to live in a house - that's what makes it financially affordable," Energy and Climate Secretary **Ed Miliband** told Reuters.

## For the Digitally Deceased, a Profitable Graveyard

By JOHN HANIC  
Published: November 12, 2008

**HARD DRIVES**, printers, fax machines and cellphones move along a conveyor belt at the rate of six tons an hour into the gaping maw of a 16-foot-tall, 60-foot-long shredder at e-Scrap Destruction, in Islandia, N.Y.



Maxine Hicks for The New York Times  
Electronic equipment comes out of the shredder at e-Scrap Destruction in Islandia, New York. More Photos »

Multimedia



slide Show  
Trashed

### BACKGROUND

Buildings have an enormous role to play in the fight against climate change as they represent around 40% of all energy use in Europe and 36% of CO2 emissions, according to the European Commission.

The EU addressed the problem by introducing minimum energy savings requirements in its 2002 energy performance of buildings directive (see [related LinksDossier](#)).

A recast of the directive was agreed in November last year (EurActiv 18/11/09).

### MORE ON THIS TOPIC

[LinksDossier: Energy Performance of Buildings Directive](#)

[News: EU reaches agreement on energy savings in buildings](#)

## Green Inc.

Energy, the Environment and the Bottom Line

March 2, 2009, 1:25 PM

## Companies Add Chief Sustainability Officers

By KATE GALBRAITH

Amid mounting job woes, at least one position seems to be gaining currency: chief sustainability officer.

This week, **SAP**, the multinational software giant, announced that it was appointing its [first-ever chief sustainability officer](#) as part of an effort to reduce carbon emissions and save energy.

Last month, **PGI**, a maker of materials for medical and industrial uses, announced the creation of a similar post, and **Flowserve**, a Texas-based maker of pumps, valves and seals, announced that its vice-president for public affairs would also take on the newly created title.

A number of other big companies, like **Sun Microsystems**, **Georgia Pacific** and **Dupont**, already have chief sustainability officers.

"We've certainly seen a trend," said Andrea Ceres, corporate programs at **Green Inc.**

"The accountability structures are more clear, and these executives have real influence over the other business lines."

— Andrea Moffat, Ceres

## First Solar joins Desertec solar project

(Reuters) - U.S. solar power company First Solar has joined the Desertec solar power project, which hopes to supply 15 percent of Europe's power by 2050 via a network of renewable energy sources.

First Solar said it was the first pure photovoltaic (PV) company to join the 400 billion euro (\$546.6 billion) project, set to be the world's biggest, that proposes sending energy created in the Sahara to local markets and to Europe.

The project had previously focused on the solar thermal technology championed by leading utility members of the project, including E.ON and RWE, where sunrays heat up liquids to power turbines.

As a result, the opening up of the project to smaller PV-focused companies, whose technology turns sunlight directly into electricity, came as something of a surprise to analysts.

"I was very surprised to see a photovoltaic company join for this one," Jon Sigurdson, manager of the Renewable Energy fund at Carlson, a unit of Norwegian DnB Nor Group, said.

"If there should be one, it makes sense that it is First Solar, based on the data we have now. But who knows what technology is most cost competitive in future years, when this (possibly) will be built?"

The Arizona-based company, which grew to become the world's biggest maker of solar cells in 2009, said on Tuesday it had joined Desertec for an initial three-year period and would contribute utility-scale PV expertise in project working groups.

Additional details on the agreement were not disclosed.

Dana Ford  
LOS ANGELES  
Tue Mar 16, 2010 11:47am EDT

### Related News

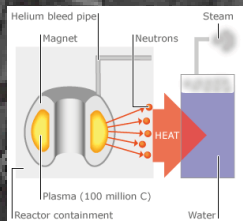
[First Solar says joins solar project Desertec](#)  
Tue, Mar 16 2010

[First Solar lands 30 MW project in New Mexico](#)  
Mon, Mar 15 2010

Entrepreneur

# BREAKTHROUGH TECHNOLOGY: NUCLEAR FUSION POWER

FUSION POWER IS GENERATED BY FUSING ATOMS TOGETHER, LIBERATING ENORMOUS AMOUNTS OF ENERGY AND WITH THE PRODUCTION OF ONLY SMALL AMOUNTS OF LOW-LEVEL RADIATION. ENERGY PRODUCED FROM THIS PROCESS IS THE SAME AS WHAT OCCURS WITHIN OUR SUN.

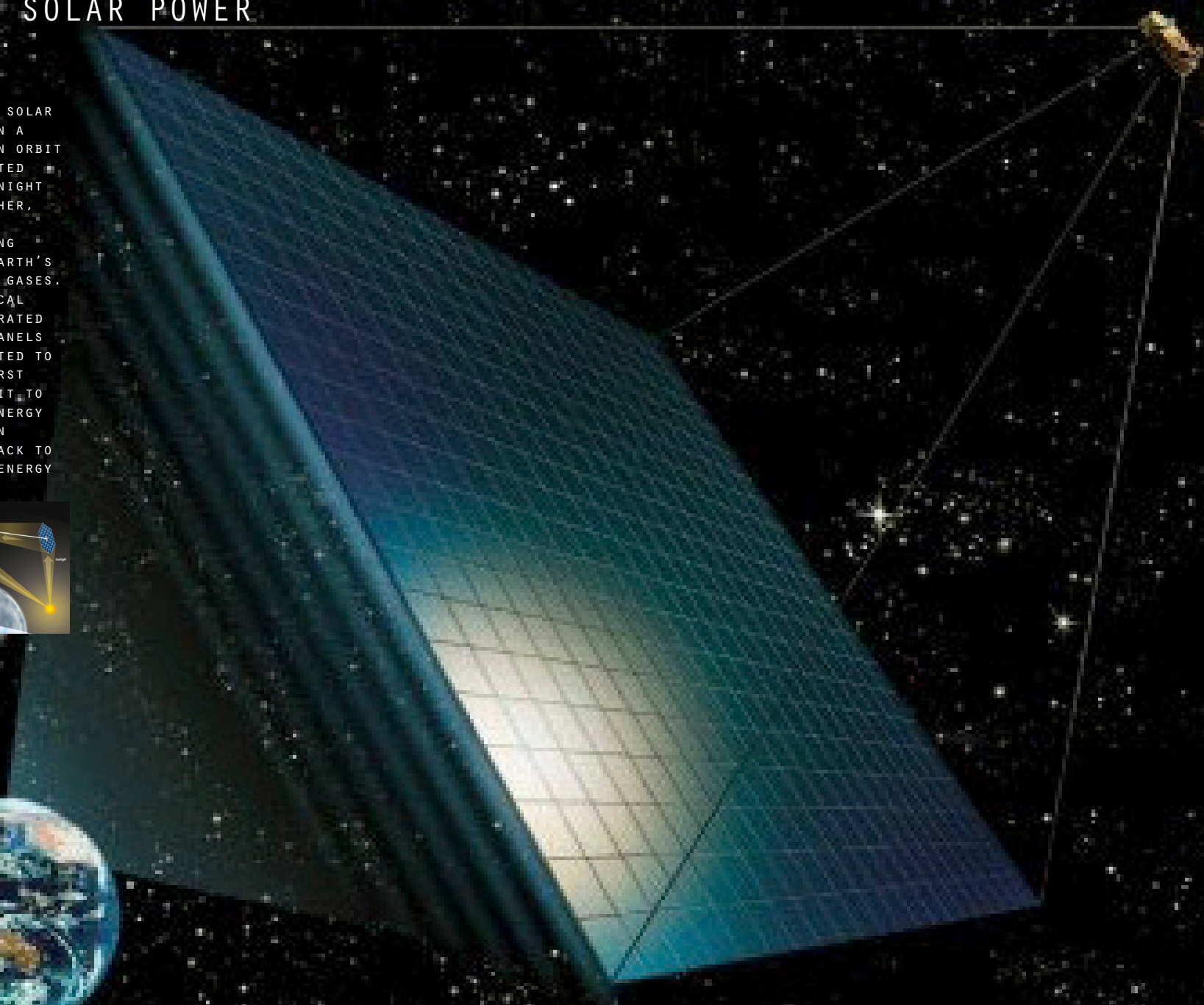
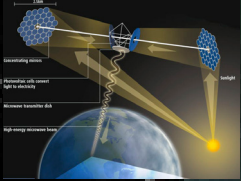


CREDITS: MARK WOOLLARD (PHOTO), BBC NEWS (DIAGRAM).

Nuclear Fusion

# BREAKTHROUGH TECHNOLOGY: SPACE SOLAR POWER

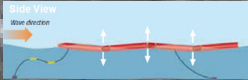
SPACE-BASED SOLAR PV PANELS ON A SATELLITE IN ORBIT ARE UNAFFECTED BY THE DAY/NIGHT CYCLE, WEATHER, SEASONS, OR THE FILTERING EFFECT OF EARTH'S ATMOSPHERIC GASES. THE ELECTRICAL ENERGY GENERATED BY THE PV PANELS IS TRANSMITTED TO EARTH BY FIRST CONVERTING IT TO MICROWAVE ENERGY THAT IS THEN CONVERTED BACK TO ELECTRICAL ENERGY ON EARTH.



Space Solar Power

# BREAKTHROUGH TECHNOLOGY: WAVE-POWER

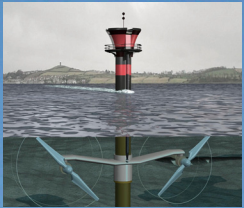
THE PELAMIS WAVE ENERGY CONVERTER IS A TECHNOLOGY THAT USES THE MOTION OF OCEAN SURFACE WAVES TO CREATE ELECTRICITY. IT CONSISTS OF A SERIES OF SEMI-SUBMERGED CYLINDRICAL SECTIONS LINKED BY HINGED JOINTS. THE WAVE-INDUCED RELATIVE MOTION OF THESE SECTIONS IS RESISTED BY HYDRAULIC CYLINDERS WHICH PUMP HIGH PRESSURE OIL THROUGH HYDRAULIC MOTORS VIA SMOOTHING HYDRAULIC ACCUMULATORS. THE HYDRAULIC MOTORS DRIVE ELECTRICAL GENERATORS TO PRODUCE ELECTRICITY.



Wave Power ●

# TIDAL STREAM POWER

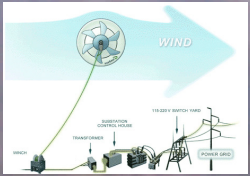
TIDAL STREAM SYSTEMS MAKE USE OF THE KINETIC ENERGY OF MOVING WATER TO POWER TURBINES, IN A SIMILAR WAY TO WIND TURBINES THAT USE MOVING AIR. THIS METHOD IS GAINING IN POPULARITY BECAUSE OF THE LOWER COST AND LOWER ECOLOGICAL IMPACT COMPARED TO BARRAGES.



Tidal Stream

# BREAKTHROUGH TECHNOLOGY: HIGH ALTITUDE WIND POWER

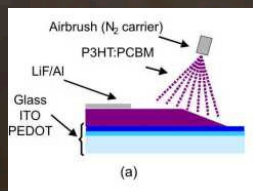
PLACING WIND TURBINES IN THE JET STREAM -15,000 TO 30,000 FEET, PROVIDES CONSTANT 100 MPH WINDS. SEVERAL COMPANIES HAVE DEVELOPED PROTOTYPE FLYING WIND TURBINES THAT TRANSMIT THE ELECTRICAL POWER TO THE GROUND VIA A CABLE THAT FIXES THE TURBINE IN PLACE.



High Altitude Wind Power

# BREAKTHROUGH TECHNOLOGY: SPRAY-ON SOLAR CELLS

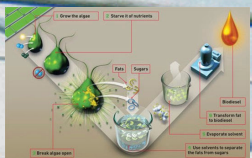
NANOPARTICLE 'INKS' COULD SOON BE USED TO PRODUCE SOLAR CELLS THAT CAN SIMPLY BE SPRAYED ONTO A ROOFTOP OR OTHER SURFACES, AND THOUGH THIS SOUNDS LIKE EXPENSIVE TECHNOLOGY, THE CHEMICAL ENGINEER WHO CREATED IT SAYS IT COULD REDUCE COSTS TO ONE-TENTH OF THEIR CURRENT PRICE. BRIAN KORGEL OF THE UNIVERSITY OF TEXAS AT AUSTIN SAYS HE BELIEVES THAT THIS REDUCTION IN PRICE COULD THRUST SOLAR POWER INTO COMPETITION WITH FOSSIL FUELS.



Spray on Solar Cells

# BREAKTHROUGH TECHNOLOGY: ALGAE BIOFUEL

ALGAE FUEL IS DERIVED FROM ALGAE - DURING PHOTOSYNTHESIS, ALGAE AND OTHER PHOTOSYNTHETIC ORGANISMS CAPTURE CARBON DIOXIDE AND SUNLIGHT AND CONVERT IT INTO OXYGEN AND BIOMASS.

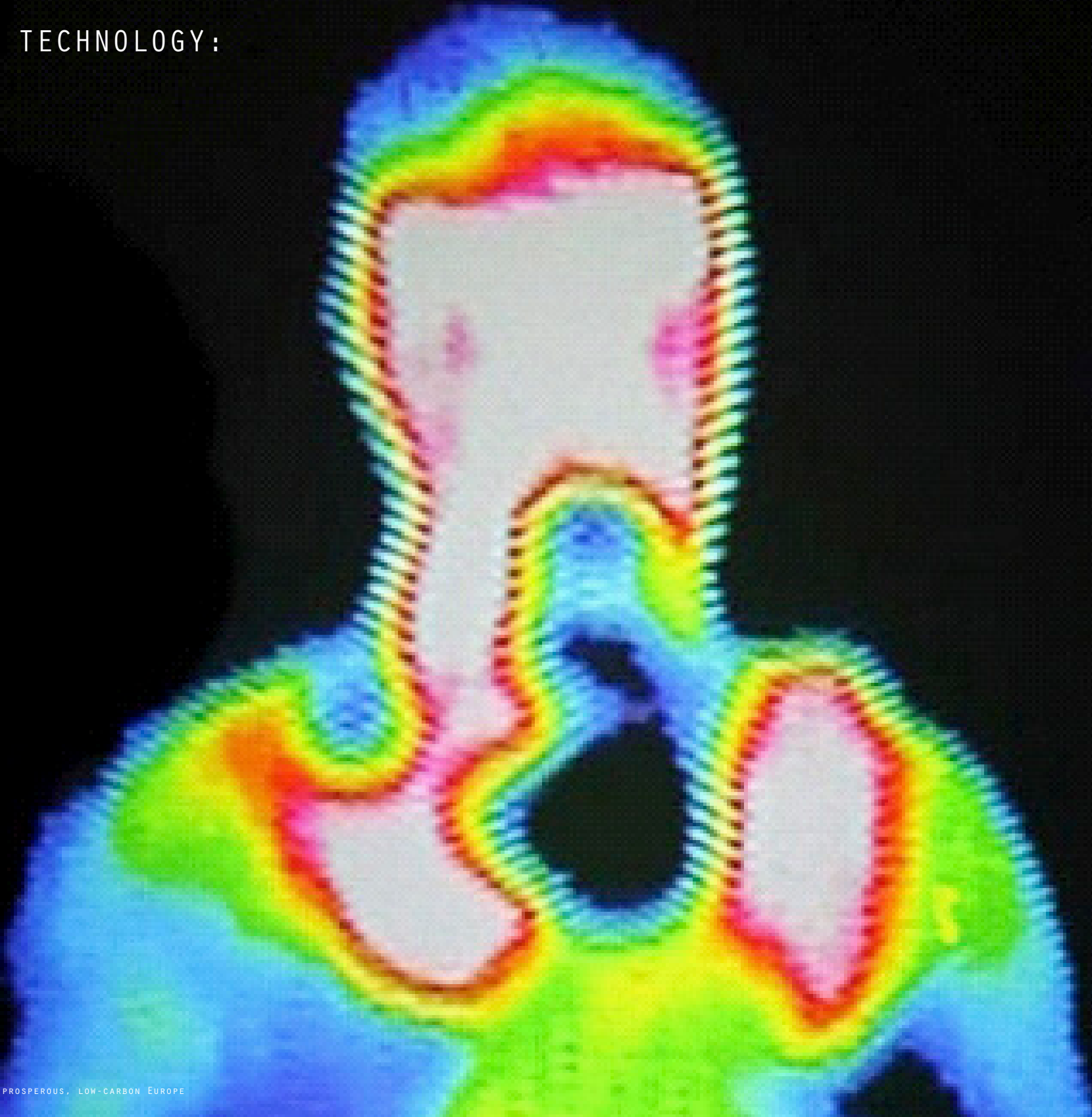


Algae Biofuel



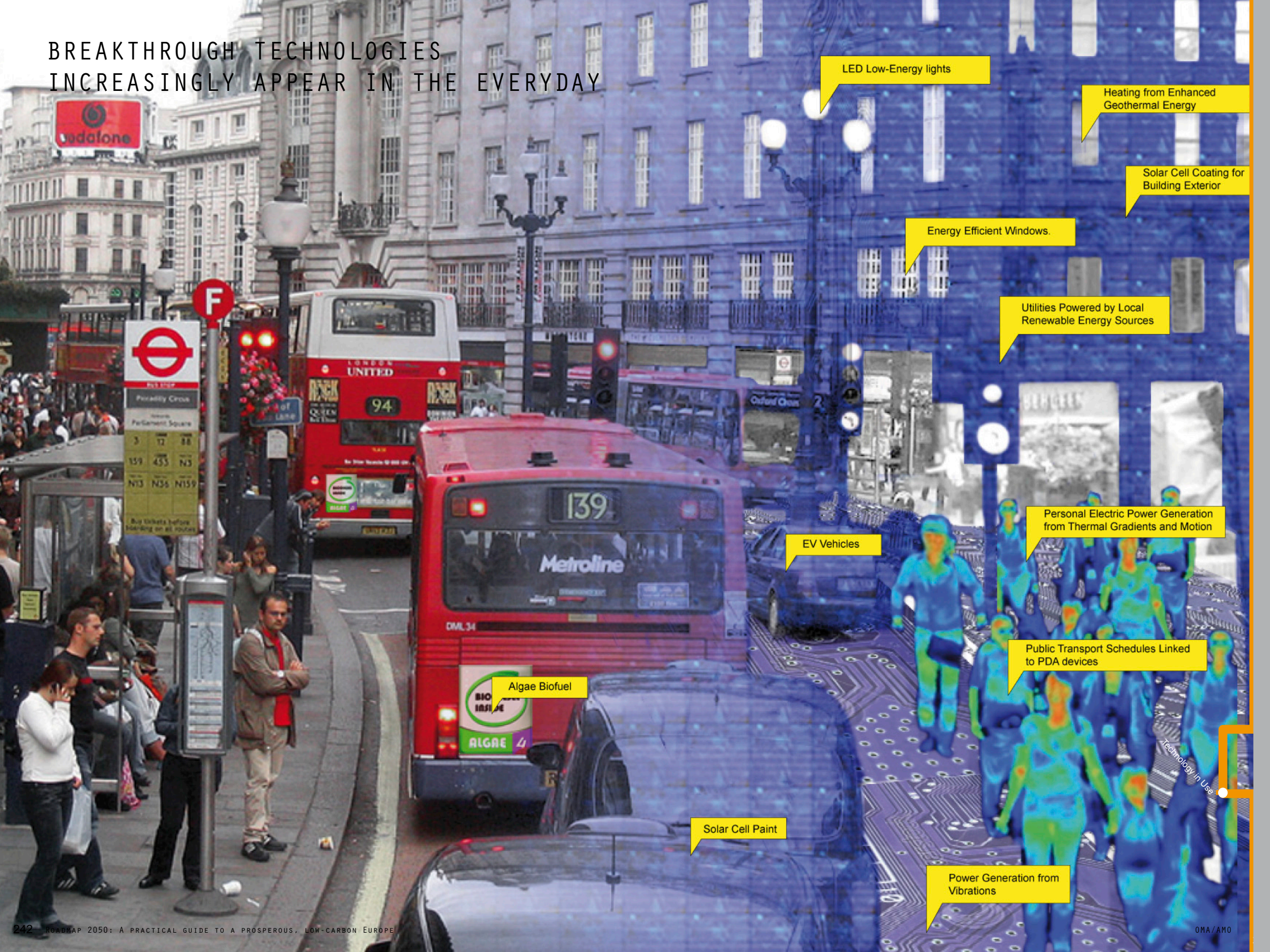
# BREAKTHROUGH TECHNOLOGY: BODY POWER

FOR MODEST ENERGY REQUIREMENTS SUCH AS PERSONAL ELECTRONIC DEVICES, AND OTHER LOW ENERGY CONSUMING PRODUCTS. BODY POWER ENERGY HARVESTING SYSTEMS CAN GATHER POWER FROM TEMPERATURE DIFFERENCES OF THE BODY, MOVEMENT (FROM BENDING OF FABRIC), OR PIEZOELECTRICITY (FROM PRESSURE SUCH AS IN THE HEEL OF A SHOE). THESE SYSTEMS COULD PROVIDE ENOUGH POWER FOR PERSONAL ELECTRONIC ITEMS, OR BIOMEDICAL DEVICES (I.E. HEART RATE AND BLOOD SUGAR MONITORS) OR ANY OTHER OTHER LOW-POWER ELECTRONICS, BUT WOULD NOT PRODUCE ENERGY THAT COULD BE HARVESTED OR STORED.



Body Power

# BREAKTHROUGH TECHNOLOGIES INCREASINGLY APPEAR IN THE EVERYDAY



LED Low-Energy lights

Heating from Enhanced Geothermal Energy

Solar Cell Coating for Building Exterior

Energy Efficient Windows.

Utilities Powered by Local Renewable Energy Sources

Personal Electric Power Generation from Thermal Gradients and Motion

EV Vehicles

Public Transport Schedules Linked to PDA devices

Algae Biofuel

Solar Cell Paint

Power Generation from Vibrations

Technology in Use

TRANSCRIPTS\_

OXFORD WORKSHOP

OXFORD, UK

8 MARCH, 2010

KALYPSO NICOLAIDIS

PROFESSOR OF INTERNATIONAL RELATIONS AND DIRECTOR OF THE EUROPEAN STUDIES CENTRE, UNIVERSITY OF OXFORD.  
KALYPSO NICOLAIDIS IS UNIVERSITY LECTURER IN INTERNATIONAL RELATIONS AT THE UNIVERSITY OF OXFORD, A FELLOW AT ST ANTHONY'S COLLEGE WHERE SHE TEACHES IN INTERNATIONAL RELATIONS AND A MEMBER OF THE FACULTY OF THE WORLD TRADE INSTITUTE, BERN, SWITZERLAND. PREVIOUSLY SHE WAS ASSOCIATE PROFESSOR AT HARVARD UNIVERSITY'S KENNEDY SCHOOL OF GOVERNMENT WHERE SHE SERVED AS THE FACULTY CHAIR FOR THE SOCRATES KOKKALIS PROGRAM ON SOUTHEASTERN EUROPE. SHE ALSO TAUGHT AT THE ECOLE NATIONALE D'ADMINISTRATION IN PARIS. IN HER RESEARCH, SHE COMBINES LONG-STANDING INTERESTS IN EXPLORING THE SOURCES AND FORMS OF CO-OPERATION IN REGIONAL AND MULTILATERAL SETTINGS AND THE DYNAMICS OF EUROPEAN INTEGRATION. SHE HAS PUBLISHED ON INSTITUTIONAL, POLITICAL AND ECONOMIC DEVELOPMENTS IN THE EUROPEAN UNION, ENLARGEMENT EASTERN AND CENTRAL EUROPE, INTERNATIONAL TRADE, THE WTO, CONFLICT RESOLUTION AND NEGOTIATION THEORY. SHE IS THE CO-EDITOR OF THE GREEK PARADOX: PROMISE VS PERFORMANCE (MIT PRESS, 1997), TRANSLATED IN GREEK AND TURKISH, AND STRATEGIC TRENDS IN SERVICES: AN ENQUIRY INTO THE WORLD SERVICES ECONOMY (HARPER AND ROW, 1989). HER UPCOMING BOOK IS ENTITLED MUTUAL RECOGNITION AMONG NATIONS: GLOBAL LESSONS FROM THE EUROPEAN EXPERIENCE. HER LAST PUBLICATION, THE FEDERAL VISION: LEGITIMACY AND LEVELS OF GOVERNANCE IN THE UNITED STATES AND THE EUROPEAN UNION IS PART OF A BROADER PROJECT CONDUCTED AT THE CENTER FOR EUROPEAN STUDIES AT OXFORD ON THE FUTURE OF EUROPE AND THE 2004 AGENDA AND IS CURRENTLY ADVISING THE GREEK FOREIGN MINISTRY ON THESE ISSUES. SHE HAS LONG BEEN INVOLVED IN ACTION-RESEARCH ON GREECE'S RELATIONS WITH THE BALKANS AND TURKEY.  
NICOLAIDIS HOLDS A PHD IN POLITICAL ECONOMY AND GOVERNMENT FROM HARVARD UNIVERSITY, A MASTER IN PUBLIC ADMINISTRATION FROM THE KENNEDY SCHOOL OF GOVERNMENT, A MASTER IN INTERNATIONAL ECONOMICS AND A DIPLOME FROM THE INSTITUT D'ETUDES POLITIQUES IN PARIS.

LB: (BRIEF INTRODUCTION OF THE PROJECT)

KN: OKAY GREAT, LET'S DISCUSS THE MAIN CONCEPT OF THIS PROJECT FIRST.

LB: THE WAY THAT THIS PROJECT WAS SET UP WAS THOUGH A METHOD CALLED BACKCASTING WHICH IS OBVIOUSLY THE OPPOSITE OF FORECASTING: DECIDING WHAT THE WORLD LOOKS LIKE IN 2050 AND THEN FIGURING OUT HOW TO GET THERE. IT ALL BEGAN WHEN COUNTRIES AGREED AT THE G8 SUMMIT LAST JUNE AND THEN AGAIN ACKNOWLEDGED AT EUROPEAN COUNCIL IN OCTOBER THAT WE MUST REDUCE CO2 EMISSIONS 80% BY 2050. THAT WAS SET AS THE INITIAL GOAL BY THE ECF AND CONFIRMED BY MCKINSEY AND COMPANY.

SO WHAT DOES 80% EMISSIONS REDUCTION BY 2050 MEAN? IT MEANS COMPLETE DECARBONIZATION OF POWER AND TRANSPORT SECTORS. THE REASON FOR THIS IS THAT CERTAIN INDUSTRIES (LIKE AVIATION FOR EXAMPLE) CANNOT DECARBONIZE ENTIRELY, SO YOU HAVE TO DECARBONIZE AS MUCH AS POSSIBLE, WHEREVER POSSIBLE. THE POWER AND TRANSPORT SECTORS ARE THE MOST ADAPTABLE TO THESE STRUCTURAL CHANGES.

A: WHAT ABOUT AGRICULTURE?

LB: AGRICULTURE IS ANOTHER INDUSTRY THAT IS DIFFICULT TO FULLY DECARBONIZE, HOWEVER IT IS IMPORTANT TO NOTE THAT ITS IMPACT IS RELATIVELY SMALL. BUT TO ANSWER YOUR QUESTION AGRICULTURE NEEDS TO DECARBONIZE BY ABOUT 20% TO MEET OUR OBJECTIVE.

KN: WHAT IS INTERESTING IS THAT THEY OFFER FOUR SCENARIOS AND EACH SCENARIO HAS A DIFFERENT MIX OF TECHNOLOGIES.

WE HAVE KNOWN ABOUT THE INCREASE IN GREENHOUSE GAS EMISSIONS FOR ABOUT 30 YEARS, SINCE THE FIRST OIL SHOCK, BUT NOTHING HAS REALLY HAPPENED.

LB: THE TECHNICAL ANALYSIS PRESENTS FOUR WAYS TO GET TO 80% EMISSION REDUCTION. EACH PATHWAY HAS THE SAME NET EFFECT, BUT ARE BROKEN DOWN INTO: 40%, 60%, 80% AND 100% PERCENTAGE OF RENEWABLE ENERGY SOURCES. ENERGY DEMAND NOT FROM RENEWABLE ENERGY SOURCES ARE MET THROUGH CCS (CARBON CAPTURE AND STORAGE) OR NUCLEAR. I AM SURE ALL OF YOU PROBABLY KNOW MORE ABOUT THE INTRICATE WORKINGS OF THESE TECHNOLOGIES THAN I DO (LAUGHTER) BUT WE DO RELY UPON THIS TECHNOLOGY IN THE THREE SCENARIOS THAT ARE NOT 100% RENEWABLE. A PRIMARY OBJECTIVE OF THIS REPORT IS THAT THE ANALYSIS IS MEANT TO BE SOMEWHAT AGNOSTIC IN A WAY IT IS PRESENTED AND THAT ANY POLITICIAN COULD BUY-IN TO ANY

OF THESE SCENARIOS AND THEY CAN STILL REACH THE 80% COMMITMENT. IT IS QUITE PRACTICAL TO HAVE IT SET UP THIS WAY, AS IT ALLOWS INDUSTRY TO BUY-IN TO THE MORE CONSERVATIVE SCENARIOS AND THEN OTHERS CAN BUY-IN TO THE MORE PROGRESSIVE SCENARIOS. WHAT WE ARE TRYING TO SHOW IS THAT WITH EXISTING TECHNOLOGY OUR GOALS ARE ACHIEVABLE AND THAT IS AN IMPORTANT MESSAGE WE WANT TO SEND OUT.

DB: A LOT OF PEOPLE ARE VERY SKEPTICAL ABOUT EVEN SOME THE ESTIMATES

OF THE COST SAVINGS ON ENERGY EFFICIENCY. YOU KNOW IN THEORY THESE THINGS WILL SAVE YOU MONEY AND REDUCE YOUR GREEN-HOUSE GAS EMISSIONS. IN FACT WE HAVE KNOWN ABOUT THE INCREASE IN GREENHOUSE GAS EMISSIONS FOR ABOUT 30 YEARS, SINCE THE FIRST OIL SHOCK, BUT NOTHING HAS REALLY HAPPENED, THERE ARE STUDIES AROUND WHY THAT IS BUT CLEARLY IT MAY HAVE TO DO WITH SPECIFIC REALITIES. REALITIES LIKE: IF YOU PAY THE MONEY TO INSULATE YOUR HOUSE YOU HAVE TO BE THERE FOR A CERTAIN NUMBER OF YEARS BEFORE YOU RECOUP THE COSTS. THERE ARE INSTRUMENTS LIKE DISCOUNTING, SO IT CAN QUICKLY GET COMPLEX. FROM AN ECONOMIST'S PERSPECTIVE A LOT OF PEOPLE QUESTION THE NUMBERS MCKINSEY HAS ARRIVED AT PER SECTOR. INSTEAD OF ONE COST CURVE COVERING ALL SECTORS, THERE SHOULD BE A COST CURVE FOR EACH SECTOR, SO THERE HAS BEEN QUITE SOME CRITICISM AROUND THIS. DIETER HELM, FOR INSTANCE, IS QUITE A RESPECTED ENERGY ECONOMIST WHO IS QUITE CRITICAL TOO MUCH GENERALIZATION. I WAS WONDERING HOW YOU HAVE DEALT WITH THESE CRITICISMS?

LB: I COME FROM A POLICY AND ENGINEERING BACKGROUND SO I HAVE A VERY SPECIFIC AREA OF EXPERTISE, AND DO NOT FEEL COMFORTABLE SPEAKING ON BEHALF OF MCKINSEY'S ECONOMIC METHODOLOGY, BUT I CAN GET YOU IN TOUCH WITH THE RIGHT PEOPLE WHO COULD DISCUSS THIS WITH YOU FURTHER.

LM: FAIR ENOUGH, BUT JUST TO DISCUSS THIS A BIT FURTHER FOR NOW. ONE OF THE MAJOR CRITICISMS COMING FROM AN ECONOMIST PERSPECTIVE IS THAT THERE ARE NOT DYNAMIC EFFECTS IN YOUR CURRENT ABATEMENT COSTS IN TERMS OF LEARNING RATES. SO THE LEARNING RATES COME FROM THE BUSINESS SCHOOL LITERATURE ON TECHNOLOGY ADOPTION AND THE PROBLEM WITH THOSE CURRENT ABATEMENT COST IS THAT IN THE CASE OF TRANSPORT WE DON'T HAVE A CURRENT ABATEMENT COST FOR THE ENTIRE TRANSPORT SECTOR. AND THEY ALWAYS MAKE IT LOOK AS IF TRANSPORT WAS REALLY EXPENSIVE TO TACKLE. BUT THEY'VE KNOWN THE MARKET EFFECT, THE MARKET DYNAMICS ALL THE TIME.

DB: THAT MEANS THAT THESE TWO INVESTMENTS THAT MIGHT PAY A LOT, YOU KNOW CURVES ARE COMPLETE SHAPES, THEY ALWAYS GO IN A CERTAIN DIRECTION EVERYTHING JUST GETS SMOOTHED OUT. NUCLEAR IS A CLASSIC, THE CAPITAL COSTS ARE UPFRONT, THEY HAVE TO BE IN OPERATION FOR A CERTAIN LENGTH OF TIME TO GET YOU BACK TO ZERO, SO A LOT OF THE FUNCTIONS HAVE A TIME SCALE. EVERY SINGLE SECTOR HAS ITS OWN COST CURVE; SOME OF THEM WE KNOW QUITE WELL, WHERE AS SOME OF THEM WE DON'T UNDERSTAND AT ALL.

KN: SO WHAT YOU ARE SAYING IS: IF YOU FACTOR IN UNCERTAINTY AND RISK, YOU CAN ACCURATELY SHOW THEIR CURVE MECHANISM? I HAVE TO SAY THIS SEEMS RATHER DETERMINISTIC.

DB: LET US HEAR MORE ABOUT HOW YOU ANALYZED THE STUDY. NOW THERE ARE TWO MAJOR CONSULTANTS INVOLVED OMA AND MCKINSEY. IF YOU THINK ABOUT OMA WHAT IS YOUR STRATEGY? AND YOUR MAIN CONCERNS? ONE THING EVIDENT IS THAT YOU ARE CONSTRAINED BY THE CLIENT, GDP, PROFIT, ETC.. WE ARE LESS AFFECTED BY THIS AS ACADEMICS, SO RIGHT THERE WE HAVE THE OPPORTUNITY TO GET CLOSER TO THE TRUTH AS OPPOSED TO UNCERTAINTY. AND WHAT ARE THE POLITICS OF ALL OF THIS? HOW DO YOU PRESENT UNCERTAINTY? NEVERTHELESS WE WANT TO THINK ABOUT MOBILIZING THE POLITICAL WORLD THE DECISION MAKERS WITHIN INDUSTRY SO HOW

## WE WANT TO THINK ABOUT MOBILIZING THE POLITICAL WORLD THE DECISION MAKERS WITHIN INDUSTRY.

DO YOU DEAL WITH ALL THIS? BECAUSE WHEN YOU PUSH [MCKINSEY] ON [THE COST CURVE] THEY KIND OF GO: WELL NO THEY ARE NOT PER SECTOR, BUT IT IS PRETTY GOOD, AND IS BETTER THAN ANYTHING ELSE OUT THERE. PRACTICALLY MY QUESTION MORE THAN ANYTHING IS: WHAT IF WE MISS? DO THEY MISS? MOST BLOCKS OR FACTORS IN THE CLIMATE NEGOTIATION HAVE MADE THE COMMITMENTS CONTINGENT ON OTHER PEOPLE'S COMMITMENT, SO IF PEOPLE COME IN NOW THERE WILL BE MORE. THE EUROPEANS HAVE ACTED REMARKABLY UNILATERALLY, BECAUSE THEY WANT TO BE LEADERS. HOW WOULD NOT MEETING THE TARGETS, WHICH I THINK IS ACTUALLY MUCH MORE LIKELY THAN MEETING THEM YEARLY, PLAY INTO THAT POLITICAL ARENA THAT PEOPLE ARE MAKING CONTINGENT PROMISES TO. THIS IS ONE WAY OF MAPPING UNCERTAINTY BY FACTORING IN CONTINGENCY AND SAY LOOK: WE ARE GOING TO SPEND QUITE A LOT OF MONEY ON THIS, AND WE ARE GOING TO TRY A LEAD. IT MIGHT BE HARD AND WE ARE PREPARED TO BEAR ALL RISK ON THESE INVESTMENTS BY TRYING HARDER IF YOU GUYS BUY IN. DO YOU SEE WHERE I AM GOING?

LB: YES I DO, I ALSO THINK THAT ONE OF THE THINGS THAT WOULD BE HELPFUL TO DISCUSS TODAY: THE TECHNICAL ANALYSIS SUGGESTS THAT NOT ONLY IS THIS REALLY A SUSTAINABLE PLAN, BUT THAT IT IS TECHNICALLY FEASIBLE AND ECONOMICALLY BENEFICIAL.

LM: WHEN THEY SAY THAT THERE IS NOTHING BETTER AROUND, ARE THEY RIGHT ON THAT POINT?

DB: NOT NECESSARILY. SOMETIMES THEY TALK ABOUT MITIGATION GENERALLY NOT TO BE AS EFFICIENT, AND THERE ARE A BUNCH OF REASONS. PARTICULARLY, WE USE LIVE CASTS IN PARTICULAR INDUSTRIES, THERE IS A TRADE OFF HERE. IF YOU READ THE CLIMATE CHANGE COMMITTEES REPORT HERE IN THE UK THEY THINK WE NEED TO GET TO 80% REDUCTIONS BY 2050, HERE ARE SOME AGGREGATE NUMBERS. HOW DO YOU GET THERE? WELL, YOU KNOW WE ARE ECONOMISTS, WE DON'T PRESCRIBE. THE INDUSTRY AND THE ENERGY SECTOR HAS SAID THAT THIS IS ABSOLUTELY NO USE TO US WHAT SO EVER BECAUSE WE NEED TO KNOW A PRESCRIPTIVE PATH. SO THE MOMENT THEY PRESCRIBED THE PATH, THEY THEN LOCK IN SOME OF THOSE INEFFICIENCIES. THERE IS A TRADE-OFF BETWEEN THE SPECIFICITY AND THE EFFICIENCY, SO WHEN THEY ARE COST EFFECTIVE IT IS ALMOST DEMONSTRABLY UNTRUE; SO THEY ARE ABLE TO SPEAK ABOUT THE PATH, OR THEY ARE ABLE TO SPECIFY EFFICIENCY. IF YOU DEFINE THE PATH YOU DON'T KNOW IF IT WILL BE THE MOST EFFICIENT WAY TO SPEND YOUR MONEY. THAT IS THE PARADOX. AND IF YOU SPEND YOUR MONEY IN THE MOST EFFICIENT WAY THEN THE INVESTOR WANTS TO LEAVE IT TO MARKET ECONOMICS, BUT ENERGY EFFICIENCY IS THE SORT OF THING MARKETS ARE NOT NECESSARILY VERY GOOD AT REGULATING.

KN: IS THERE A PAPER THAT ANALYZES THE TRADE-OFF BETWEEN EFFICIENCY AND SPECIFICITY? BECAUSE IN THE ROADMAP 2050 IT IS ACTUALLY ABOUT SPECIFICITY ALTHOUGH THEY GIVE YOU FOUR SCENARIOS.

## THE EUROPEANS HAVE ACTED REMARKABLY UNILATERALLY, BECAUSE THEY WANT TO BE LEADERS.

THE INVESTOR  
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REGULATING.

SPECIFIC TERM IN THE CONTINGENCY PLAN HOWEVER I DO NOT THINK THAT THIS REPORT RIGHT NOW HAS BUILT IN HOW WE WILL ACTUALLY ESTABLISH THIS. WHO DO YOU PRESENT IT TO? HOW DO YOU PRESENT IT? WHO HAS TO COMMIT? THIS IS ONE OF THE PROBLEMS THAT COMES UP REFLECTION GROUP REPORT IS THAT SAY EUROPE NEEDS A COMMON INTEGRATED ENERGY POLICY BUT THERE'S NO STATEMENT ABOUT WHAT THAT MEANS. IS IT BOTTOM-UP APPROACH, IS IT TOP-DOWN APPROACH. HOW DO YOU ACTUALLY PROPOSE THIS? HOW ARE THE COMMITMENTS ENFORCED? HOW ARE THE COMMITMENTS MET? I DO REALLY BELIEVE IN THIS PROJECT AND I HAVE LEARNED A GREAT DEAL AND I BELIEVE THERE ARE A LOT POSITIVE ARGUMENTS. BUT IMPLEMENTATION SEEMS TO BE MUCH MORE COMPLEX WHEN YOU REALLY THINK ABOUT THE IMPLICATIONS OF THE PLAN.

LM: THAT SEEMS TO BE A PROBLEM FOR A POLICY AGENCY HERE. BUT THE OTHER ISSUE HERE THAT STRIKES ME IS THAT ONLY AN ENERGY DIMENSION IS BEING CONSIDERED. AND IF YOU LOOK FOR INSTANCE FROM MY PERSPECTIVE ON BIODIVERSITY, THIS PROPOSAL COULD POTENTIALLY BE VERY DEVASTATING. LOOK AT NATIONAL ENERGY AUTONOMY, SOME PEOPLE DON'T THINK ABOUT THAT, THEN IT IS VERY DIFFICULT, AND SO IF YOU REALLY WANT TO IMPLEMENT THINGS IT WILL HAVE TO GO THROUGH THE POLITICAL PROCESS WHERE IT WILL BE CROSSED EXAMINED ON MANY DIFFERENT DIMENSIONS. A REPORT LIKE THIS IS ALMOST A MONO-DIMENSIONAL STATEMENT. YOU HAVE TO DISCUSS WITH OTHER PEOPLE. FOR INSTANCE, IF I AM TRYING TO CONSULT EUROPE'S DIVERSITY, OR I AM TRYING TO KEEP THE GEOPOLITICS OF ENERGY IN EUROPE IN A WAY THAT DOESN'T HARM SOME INTEREST, ETC... A REPORT LIKE THIS IS ONLY ONE VOICE AT THE TABLE. TO TRY TO ANSWER YOUR QUESTION, WHAT OTHER VOICES DOES THE REPORT HAVE TO DISCUSS? OF COURSE YOU CANNOT CONSIDER EVERY RESPONSE ON EVERY DIMENSION, IF I DID A REPORT ON BIODIVERSITY YOU WOULD REORGANIZE THE EUROPEAN LANDSCAPE, ETC.. I WOULD THEN SAY NOW WE HAVE MORE CLEAR REPRESENTATION. HOWEVER THIS DOES NOT NECESSARILY MEAN WHAT THIS SHOULD BE DONE.

LB: I THINK THAT THERE ARE TWO THINGS THAT ARE MISSING FROM THIS CURRENT TABLE. THE FIRST, IS THE POLICY RECOMMENDATIONS WHICH ARE

DB: I CAN EXPLAIN A LITTLE BIT ABOUT WHAT THIS PAPER IS ABOUT. IT SHOULD ALSO BE ON THEIR WEBSITE. THEY WANT TO ADDRESS SOME THINGS LIKE THE RENEWABLE TARGET AND VEHICLE EMISSIONS STANDARDS AND SOME OF THOSE ARE QUITE SPECIFIC TARGETS, AND I THINK THEY ARE TRYING TO SAY LOOK THIS IS NOT NECESSARILY LEAST COST. IT IS AN EASY BALL TO KICK, IT IS AN EASY GOAL TO SCORE. HOWEVER I DO THINK IT IS IN GENERAL A DECENT PIECE OF WORK.

LB: EVEN THOUGH IT IS THEIR CLAIM TO OFFER BOTH SPECIFICITY AND EFFICIENCY, WHAT THEY ARGUE FROM AN INCENTIVE PERSPECTIVE IS THAT IF WE INTEGRATE WE WILL BE MORE LIKELY TO MEET THESE EMISSION TARGETS. THIS COULD BE A

STILL BEING WRITTEN AND WHICH I ALSO HAVE NOT SEEN. I DO HOPE THEY OFFER SOME SPECIFIC RECOMMENDATIONS OF WHAT WE NEED TO DO. THE SECOND IS A PARALLEL EFFORT BY THE CLIENT TO MEET WITH BOTH MEMBER STATE REPRESENTATIVES AND MEMBERS OF THE EUROPEAN PARLIAMENT IN AN EFFORT TO GET THIS WHOLE EFFORT AND THE WHOLE REPORT ON THEIR RADAR. THAT'S ALSO WHY THE REFLECTION GROUP WAS APPROACHED TO PRESENT SOME

THE MESSAGE THAT  
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BE IMPOSSIBLE.

EXTENT, BUT WHAT THEY ARE TRYING TO DO IS TO COMMUNICATE THE MESSAGE THAT WITH EXISTING TECHNOLOGY WE CAN ACTUALLY REACH THE 80% TARGETS IS AN IMPORTANT MESSAGE IN ITSELF. THERE ARE A LOT OF PEOPLE THAT BELIEVE IT TO BE IMPOSSIBLE. A LOT OF PEOPLE BELIEVE WE CANNOT DO ANYTHING ABOUT IT. AND THAT IS AN IMPORTANT MESSAGE THEY WANT TO SEND TO THE COMMISSION. THE CONSEQUENCE IS THAT YOU MUST THINK ABOUT EUROPE AS A COMMON ENERGY AND ENVIRONMENTAL SPACE WHERE YOU ACTUALLY MAKE USE OF THE RELATIVELY LARGER ADVANTAGES OTHERS HAVE IN CERTAIN COUNTRIES, SOME HAVE WIND SOME HAVE WATER AND HOW MUCH EXTRA ENERGY DO WE NEED..

DB: WE WOULD NOT HAVE GOT WHAT WE NEEDED, BECAUSE THE JET-STREAM IS ON THE WRONG SIDE.

C: BUT THERE YOU HAVE IT, THIS IS ALSO WHAT CAME UP AND THERE WAS SOME DISCUSSION, HOW MUCH EXTRA ENERGY DO WE NEED?

DB: MAYBE WE NEED TO DECREASE ENERGY CONSUMPTION? (LAUGHTER)

C: MCKINSEY ARGUES: WE KNOW ALL OF THIS BUT WE CANNOT WATER DOWN THE CENTRAL MECHANISM. I AM PUTTING IN ALL OF THE CRITICISMS. HOWEVER THE NEXT STEP HAS TO BE WHERE DO WE GO FROM HERE?

OF THESE IDEAS AND SOME OF THESE FINDINGS AND INTEGRATE IT INTO THE OTHER WORK THEY ARE DOING.

LM: WHAT DO YOU MEAN OTHERS WORK?

LB: IN THE END WHEN IT'S FORMALLY PRESENTED THE IDEA IS THE COMMISSION OR THE PARLIAMENT WOULD ADOPT THE IDEAS. SO WE CAN HELP TO INTEGRATE THE IDEAS FROM ANOTHER ANGLE INTO THE EU PARLIAMENTARY PROCESS.

C: I ATTENDED THE ROTTERDAM CONFERENCE AND THERE WAS A CRITICISM THAT CAME UP, PUBLICALLY AS WELL AS PRIVATELY. IT RELATED TO THE SOCIAL COST AND PROBLEMS OF IMPLEMENTATION ARE THE GEOPOLITICAL CONTEXT. MCKINSEY DEFENDED THAT THEY ARE AWARE OF THE HOLES AND THAT THEY CANNOT SOLVE EVERY PROBLEM TO THE FULLEST

THE CONSEQUENCE  
IS THAT YOU  
MUST THINK  
ABOUT EUROPE  
AS A COMMON  
ENERGY AND  
ENVIRONMENTAL  
SPACE.

DB: PAY SOME RESPECT TO: WE CAN DO THIS WITH CURRENT TECHNOLOGY, BECAUSE IN MY VIEW, THE PROBLEM IS WITH EXHAUSTIBLE RESOURCES, THERE IS ONLY A CERTAIN AMOUNT OF CUMULATIVE EMISSIONS WE CAN MANAGE BETWEEN NOW AND FOREVER AND THAT WILL GIVE US TWO DEGREES OF WARMING. WE HAVE FOUR PAPERS AND NATURE DESCRIBING THIS, WE WILL HAVE ABOUT HALF THE AMOUNT OF CARBON TO PLAY WITH SO WHAT THAT MEANS IS THAT WE HAVE A METAPHORICAL GOLD MINE AND WE ARE SPENDING IT. SO WHAT YOU DO FROM AN ECONOMIST POINT OF VIEW IS THAT YOU INVEST TO BE RESOURCE FREE. SO IN OTHER WORDS IF YOU HAVE GOLD MINE IN YOUR BACKYARD, WHILE YOU ARE SELLING GOLD WHAT YOU DO WITH THE MONEY THAT YOU MAKE WHILE SELLING THE GOLD IS TO INVEST IN GUARANTEEING YOUR FUTURE REVENUE STREAM. YOU DON'T GILD YOUR HOUSE WITH GOLD OR BUY ROLLS ROYCES. IN THIS CONTEXT WHAT I MEAN IS YOU MUST INVEST HEAVILY IN NEW TECHNOLOGY THAT LOWERS THE CARBON RELIANCE PER KILOWATT HOUR. THIS BASICALLY AVOIDS THE PROBLEM OF FOSSIL FUELS ENDING ALTOGETHER.

### INVEST HEAVILY IN NEW TECHNOLOGY.

ON THE OTHER HAND IF YOU SAY WE CAN DO IT WITH CURRENT TECHNOLOGY YOU BASICALLY ARE GIVING PEOPLE THE GREEN LIGHT TO JUST SPEND THE CASH, AND THAT IS WHAT THEY WILL DO, AND WHAT YOU END UP DOING IS FUELING CONSUMPTION

AND NOT INVESTMENT AND I SEE THAT AS A COMMON PROBLEM WITH ALL THE MAJOR PROPOSALS ON THE TABLE AT THE MOMENT. THEY ARE ALL ABOUT WHO GETS WHAT. BECAUSE IF THEY FAIL THEY CAN ALWAYS FALL BACK ON THE NEW TECHNOLOGY, IF YOU LOOK AT DAVID MCKAY'S MAP OF BRITAIN, THAT BASICALLY HE DESTROYS BIODIVERSITY AS A TRADE OFF INITIATIVE. SO THE ARGUMENTS THAT WE CAN DO IT ALL WITH CURRENT TECHNOLOGY IT WOULD JUST TAKE MASSIVE AMOUNTS OF INFRASTRUCTURE. I WOULD ARGUE THAT SOME OF THE COUNTER ARGUMENTS USED TO DEPLOY REPORTS LIKE THE ONES IS: THEY SUSPICIOUSLY SAY THAT WE CAN REACH OUR TARGETS WITH CURRENT TECHNOLOGY, ARE ACTUALLY COUNTER-PRODUCTIVE, SO I DO THINK THAT SOME OF THE RISKS ARE ACTUALLY PRETTY SEVERE. I FEAR THAT EUROPE COULD LOCK ITSELF ONTO A PATH THAT BY 2040 LOOKS OBSOLETE.

LM: LET ME MENTION JUST TWO EXAMPLES FROM FRANCE. IN FRANCE WE USE PUBLIC FUNDS FOR UTILITY COMPANIES, ELECTRICITY COMPANIES, OR WIND ENERGY COMPANIES. THE RESULTS ARE THINGS LIKE: IF YOU BUILD A WINDMILL IN FRANCE THERE IS A TABLE OF CORRESPONDENCE WHERE BY THE LESS WIND THERE IS THE MORE SUBSIDIZED YOU ARE SO THAT THEY MAKE THE SAME PROFIT WITH DIFFERENT

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AMOUNTS OF WIND. ACTUALLY AS A RESULT THEY ARE BUILDING INEFFICIENT WINDMILLS. THE SAME IS HAPPENING WITH SOLAR ROOF PANELS AND THAT IS EXACTLY THE KIND OF IMPACT YOU ARE MENTIONING. IT IS NOT VERY EFFICIENT, IT IS HIGHLY CONSUMPTIVE OF PUBLIC FUNDS, AND IT IS NOT GOOD ENVIRONMENTALLY.

LB: BECAUSE WE ACTUALLY IN OUR BOOK WE PUT IN 100% SCENARIO THEY SAY IN ORDER TO ACHIEVE THAT TO ONLY RELY ON RENEWABLE ENERGY YOU MUST HAVE ENHANCED GEOTHERMAL, WHICH IS THE BREAKTHROUGH THAT THEY SEE AS THE MOST FEASIBLE TECHNOLOGY TO-DATE AND THEN OF

IF YOU DON'T  
WANT TO PUT  
WINDMILLS  
EVERYWHERE  
AND CONVERT  
EVERYTHING INTO  
BIOMASS, THEN WE  
MUST INVEST IN  
TECHNOLOGICAL  
BREAKTHROUGHS.

COURSE YOU MUST HAVE SOLAR FROM NORTH AFRICA. WE HAVE INCLUDED AN ADDITIONAL SELECTION OF BREAKTHROUGH TECHNOLOGIES TO TRY TO THINK BEYOND TECHNOLOGY THAT MAY BECOME OBSOLETE. BUT THEY DID HAVE SOME RESERVATIONS ABOUT INTRODUCING BREAKTHROUGH TECHNOLOGY BECAUSE IT RAISES THE QUESTION WHETHER IT IS ACTUALLY FEASIBLE. ONE OF THE CLAIMS OF THE REPORT IS THAT ALL THESE GOALS CAN BE ACHIEVED WITH CURRENT TECHNOLOGY. SO IN THE END WE DECIDED TO INCLUDE A SECTION AT THE BACK OF THE BOOK THAT HIGHLIGHTS A FEW INTERESTING FUTURE TECHNOLOGIES.

LM: YES, BUT MY PROBLEM IS WITH THE REASONING. ON THE ONE HAND YOU ARE REASONING IN TERMS OF PRINCIPLES AND ORDERS OF LANGUAGES, WHICH SAY IT WOULD NOT BE POSSIBLE TO, BUT ASSUMING THAT THIS COULD BE TRANSLATED DIRECTLY INTO POLICY OBSTRUCTION AS IMPLEMENTABLE POLICY. WHAT YOU CAN DO WITH THE REASONING IN TERMS OF ORDERS OF MAGNITUDE AND POSSIBILITY IS TO USE IT TO INJECT INTO THE NEGOTIATIONS OR INTO PUBLIC DEBATE. SOME OF THESE ARENAS YOU DISCUSS WITH OTHER PEOPLE WHO HAVE OTHER CONCERNS. FOR INSTANCE I CAN IMAGINE A FLOOR FOR PUBLIC DEBATE, WHERE-BY YOU MASSIVELY INJECT THE MESSAGE THAT IN TERMS OF ORDER OF MAGNITUDE WE MIGHT DO IT WITH CURRENT TECHNOLOGY PEOPLE ARE GOING TO START COMPLAINING THAT IT'S GOING TO DESTROY THE LANDSCAPE, THE BIODIVERSITY AND RUIN THEIR HOMES, ETC.. AND THEN THE DISCUSSION CAN CONTINUE. AT THAT POINT YOU CAN THEN SAY: OK BUT, IF YOU DON'T WANT TO PUT WINDMILLS EVERYWHERE AND CONVERT EVERYTHING INTO BIOMASS, THEN WE MUST INVEST IN TECHNOLOGICAL BREAKTHROUGHS. BUT AT LEAST YOU'VE GOT THE DISCUSSION STARTED. I THINK IF YOU TRY TO DO A SEPARATE STUDY WHICH TRIES TO TRANSLATE THE IDEAS DIRECTLY INTO IMPLEMENTABLE ACTION THIS COULD BE PROBLEMATIC.

KN: IN A WAY IT WOULD MAKE YOUR JOB EASIER, TO KEEP THE IDEAS MORE CONCEPTUAL AND VISIONARY, AS OPPOSED TO WORKING OUT ALL THE DETAILS. BECAUSE IT IS ABOUT GETTING THE DISCUSSION STARTED.

B: WHAT IF WE CAN'T DO THIS? THE METEOROLOGY OFFICERS HAVE STOPPED DOING SEASONAL FORECASTS, NOT BECAUSE THEY ARE THAT BAD BUT BECAUSE WILLFUL MISINTERPRETATION MAKES THEM LOOK SILLY, AND THEY JUST SAY WELL THIS ISN'T WORTH IT SO WE WILL JUST STOP, SO WHAT THAT MEANS IS THAT A WHOLE BUNCH OF PEOPLE WHO ARE PSEUDO SCIENTIST ARE THE ONLY PEOPLE OFFERING A SEASONAL FORECAST NOW. BUT IN BRITAIN IT IS THE PSEUDO SCIENTISTS WHO SAY WELL WE CAN DO SEASONAL FORECASTS THE METEOROLOGY OFFICERS CANNOT.

KN: YOU KNOW THE STORY, LAST YEAR THEY PREDICTED A BBQ SUMMER AND THEN IT RAINED THE ENTIRE TIME. SO THEY STOPPED DOING SEASONAL FORECASTS AND ONLY WILL DO IT MONTHLY NOW.

B: THEY SEE IT, AND WE CANNOT DO THAT, AND THAT LEAVES THE FIELD OPEN TO PEOPLE WHO CANNOT DO IT EITHER TO DO IT. I THINK JUST BEING HONEST ABOUT JUST HOW HARD IT IS. I MEAN MAYBE WE CANNOT. THE SCALE

OF INFRASTRUCTURAL CHANGES ARE PHENOMENAL, IF YOU LOOK AT ALL THE INFRASTRUCTURE JUST AROUND OXFORD DATING BACK TO 1960 THERE IS QUITE A BIT, EVERYTHING OUTSIDE AND INSIDE. THERE IS AN AWFUL LOT OF STUFF THAT HAS A TURNOVER TIME OF MORE THAN 50 YEARS.

LB: EVEN JUST CHANGING THE WINDOWS IS BIG EXPENSE AND A LOT OF WORK.

B: EXACTLY THERE ARE A LOT OF THINGS THAT NEED TO CHANGE TO GET TO 100% THAT POSSIBLY DON'T NEED TO CHANGE TO GET TO 50% OR 60% AND UNDERSTANDING THAT INCREMENT AND TAKING THE TARGET THAT THEY HAVE GIVEN. I UNDERSTAND WHY THAT IS DONE, BUT I ACTUALLY THINK THAT IF POLICY MAKERS COULD SEE, WELL WE CAN GET TO 50% OKAY, BUT THE COST CURVE BLOWS OUT WHEN YOU GET TO 100%, MAYBE IT DOESN'T GO VERTICAL BUT IT GOES KIND OF NEAR VERTICAL.

L: THIS IS PRECISELY WHAT YOU ARE CRITICIZING IN THE MCKINSEY REPORT?

B: YES IT IS, IT IS I AM REALLY SAYING IT AS A DEMONSTRATION. THE MCKINSEY CURVE GOES KIND OF FLAT TOWARDS THE END.

KN: I ALSO HAD THIS QUESTION, I CAN'T FIND IT HERE. THERE IS ALSO THE COST CURVE WHICH THEY AGGREGATED ALL SORTS OF THINGS, AND NOTHING WAS SAID ABOUT THE FINAL COST CURVE.

S: THERE ARE THE NEGATIVE AND THE POSITIVE COSTS. AS LONG AS YOU ARE IN THE NEGATIVE RANGE YOUR COST EFFECTIVE TECHNOLOGIES ARE FINE, BUT ONCE YOU PASS OVER TO THE OTHER SIDE THEN IT IS RESPECTIVE. BUT ONE OF THE OLD PROBLEMS IS THAT THERE IS NO FEEDBACK EFFECT. SO IN TERMS OF ECONOMICS, PEOPLE ALWAYS TALK ABOUT THE REBOUND EFFECT, BUT ENGINEERS HATE THAT IDEA. ACTUALLY THERE IS EMPIRICAL EVIDENCE; YOU CAN LOOK AT THE UK TREASURY. THERE WAS A STUDY DONE BY CAMBRIDGE WITH EMPIRICAL EVIDENCE ON THE SIZE OF THE REBOUND AND SOME PEOPLE SAY IT IS 5% OTHER EXPERTS SAY IT IS 20%. I WOULD SAY IN THE AIRCRAFT INDUSTRY IT IS PROBABLY 30%. IF YOU USE DATA FROM EASYJET FOR EXAMPLE, THE FEEDBACK EFFECTS ARE IGNORED COMPLETELY IN THIS AGGREGATED ABATEMENT COST CURVE. THAT IS A MAJOR WEAKNESS. WHAT ARE YOU DOING TO DO WITH THE DEMAND SIDE? IS THAT CONSTANT OR DO YOU ASSUME LIVING STANDARDS WITH EXPAND FOREVER?

LB: THEY AGAIN CLAIM THAT THEY HAVE FACTORED IN ALL OF THESE ELEMENTS INTO A CONSERVATIVE LEARNING RATE. ALSO THERE IS A CERTAIN AMOUNT OF DEMAND SIDE MANAGEMENT INCLUDED IN THE STUDY IN TERMS OF INVESTMENT INTO SMART GRIDS AND RELATED ENERGY DISTRIBUTION NETWORKS. THEY CLAIM THAT BY FACTORING IN THE CAPACITY REQUIREMENT THEY ARE ASSUMING A CERTAIN STANDARD OF LIVING THAT WILL REMAIN.

G: WHAT ABOUT LIFECYCLE? ARE YOU TAKING INTO ACCOUNT THE DIRECT ENERGY USE WITH BIO FUELS FOR EXAMPLE?

LB: AS FAR AS I KNOW YES. BUT I HAVE HAD A SIMILAR EXPERIENCE THAT WHEN YOU SCRATCH THE SURFACE YOU REALIZE THAT IT IS NOT REALLY A QUESTION YOU ARE SUPPOSED TO ASK.

DB: WITH REGARDS TO THE MCKINSEY ANALYSIS WHAT TYPE OF LEARNING

RATES DO INCORPORATE.

LB: WELL I AS I SAID I CANNOT SPEAK FOR THEM. THEY CLAIM THEY HAVE INCORPORATED A CONSERVATIVE LEARNING RATE TO THE EQUATION, BUT TO WHAT EXTENT I CAN'T ANSWER THAT. THIS CONVERSATION IS VERY HELPFUL TO US BECAUSE WE ARE OFTEN LIMITED BY THE WAY THE TECHNICAL ANALYSIS HAS BEEN DONE. BUT MORE SPECIFICALLY HOW CAN WE USE OUR EXPERTISE AS THE ORGANIZATION THAT WE ARE, TO TAKE MORE OWNERSHIP OF THE POSITIVE THINGS THAT HAVE BEEN ESTABLISHED?

LM: IN GENERAL IT IS GOOD TO BE OPEN TO CRITICISM AT IN THE EARLIER STAGES OF THE PROJECT.

LB: THAT IS WHY I FRAMED THE QUESTION OF HOW DO YOU SEE IT COMING ABOUT OR BEING INTEGRATED? IF YOU CAN LET GO OF THE DOUBT FOR JUST A MOMENT, AND SAY OK THERE ARE SOME VIABLE POINTS THAT ARE BEING MADE, AND THINGS TAKEN TO ACCOUNT THAT CAN HELP FOR THE FUTURE. HOW DO WE MAKE SURE THEY ARE BEING COMMUNICATED APPROPRIATELY TO A POINT WHERE THEY CAN BE IMPLEMENTED OR WE CAN INFLUENCE THE PROCESS IN SOME WAY?

LM: IF I CAN SEE THIS REALLY IMPLEMENTED, THE DYNAMICS OF PUBLIC POLICY, IT IS NOT SO MUCH WORK TO OPTIMIZE OURSELVES OR FINDING THE MOST EFFICIENT PATHWAY, I HAVE NEVER SEEN A PUBLIC POLICY THAT JUST COLLECTS THE BEST ECONOMIC PARTS. IT IS A MATTER OF IMPLEMENTING LARGE SCALE FEASIBLE PROGRAMS. I WAS LAUGHING AT THE UK WINDOWS. BUT IN FRANCE FOR INSTANCE PEOPLE HAVE MASSIVELY REPLACED THEIR WINDOWS AND THEY STARTED DOING THAT 15 YEARS AGO. IT IS A WHOLE COMPLEX ARRANGEMENT OF TAX BREAKS. SO IF YOU CHANGE YOUR WINDOWS YOU BENEFIT. THERE IS A WHOLE INDUSTRY BUILD AROUND PEOPLE CHANGING THEIR WINDOWS. THEY EVEN HAVE WINDOWS WITH THE SAME ASPECT; THEY LOOK JUST THE SAME AS THEY DID BEFORE. THE ECONOMICS OF THE SOCIAL NORM WORKS BECAUSE IT IS EFFICIENT AND SUBSIDIZED.

IF YOU GIVE MASSIVE TAX BREAKS TO ELECTRIC CARS AND IF ELECTRIC CARS SUCCEED YOU HAVE LESS TAX CAPITAL TO USE.

LB: RELATING TO THIS IDEA, I WAS SURPRISED TO DISCOVER DURING AN INTERVIEW THAT IN THE MIDDLE-EAST I BELIEVE IT WAS SPECIFICALLY LEBANON. THERE IS A TAX ON HYBRID VEHICLES BECAUSE THEY HAVE TWO ENGINES. SO IN LEBANON YOU ARE DISCOURAGED THROUGH POLICY AND IN MOST EUROPEAN COUNTRIES YOU ARE ENCOURAGED.

LM: THERE IS THE STORY OF THE ELECTRIC CAR. THIS HAS BEEN AROUND WHEN I STARTED WORKING IN 1979. I HAD THE CHANCE TO MEET WITH RETIRING RESEARCHERS WHO HAD BEEN WORKING ON ELECTRIC CARS FOR ABOUT 15 YEARS. THEY WERE ACTUALLY WORKING

ON THE FAILURE OF ELECTRIC CARS. THE PROBLEM THEY WERE TRYING TO PREVENT IS THAT IF YOU GIVE MASSIVE TAX BREAKS TO ELECTRIC CARS AND IF ELECTRIC CARS SUCCEED YOU HAVE LESS TAX CAPITAL TO USE. I ALSO SPOKE WITH FRIENDS IN THE CAR SECTOR AND THEY WERE SAYING THE SAME THING. THERE ARE HIDDEN MESSAGES THAT YOU CANNOT DEVELOP ELECTRIC CARS ON A MASSIVE SCALE UNLESS SOME DEAL HAS BEEN WORKED OUT WITH ELECTRICITY FOR CARS WITH THE SAME FLEXIBILITY AS WITH PETROL,



BECAUSE THE TAX BASE IS PAID ON TRANSPORTS, SO YOU CANNOT ALLOW ONE THIRD OF THE POPULATION TO DRIVE TAX-FREE. YOU NEED TO ALSO THINK ABOUT THE TAX BASE.

S: THE STORY OF THE ELECTRIC VEHICLE IS QUITE COMPLEX. IF YOU DON'T TAKE INTO ACCOUNT THAT CHINA AND BOLIVIA HAVE THE LARGEST RESERVES OF LITHIUM IN THE WORLD, AND THAT LITHIUM IS A KEY COMPONENT IN EV BATTERY FABRICATION, THESE COUNTRIES WILL HAVE A TREMENDOUS ADVANTAGE. CURRENTLY TOYOTA IS TRYING TO BUY THE LAND, IN BOLIVIA BUT THEY HAVE NOT BEEN SO SUCCESSFUL, BOLIVIA DOES NOT WANT TO SELL. THERE ARE DEFINITELY LIMITS IN THE EV INDUSTRY. THE OTHER PROBLEM WITH ELECTRIC CARS, WE ARE TALKING ABOUT FRENCH ELECTRICITY, OR

YOU HAVE COMMITTED US TO A LARGE SCALE TRANSFORMATIONAL CHANGE AND YOU TOLD POLICY MAKERS IT WAS FEASIBLE AND WE COULD DO IT, BUT WHAT IF IT TURNS OUT TO BE REALLY EXPENSIVE?

FEASIBLE AND ALSO MAYBE MADE ATTRACTIVE TO THE PUBLIC. WHEN I SAY ATTRACTIVE I MEAN THEY HAVE THE LEAST REGRET, IN TERMS OF SOCIAL AND ENVIRONMENTAL IMPACT AS POSSIBLE.

DB: TRYING TO BE A SNIPER HERE TO PICK OFF THE BEAT. I THINK THAT IS REALLY HARD. BUT I AM INCLINED TO THINK THAT A BIG PORTFOLIO OF APPROACHES SHOULD BE USED IN DIFFERENT PLACES AND SEE WHERE YOU GET TO. YOU ARE RIGHT IT IS NOT PURE ECONOMIC COSTS WHICH IS GOING TO BE THE DETERMINACY HERE MY THINKING IS THAT ON THESE TYPES OF PROJECTS IS ACTUALLY ABOUT POLITICAL WILL IN PARTICULAR AND FOR MANY IN TERMS OF SUSTAINABILITY OF POLITICAL WILL. LOOK AT THE RATE OF GROWTH BETWEEN 2010 AND 2020 IT GOES UP BY SECTOR BY A FACTOR OF 5, DO YOU BELIEVE IT? HERE IN 2010, A QUARTER OF THE WAY THROUGH DO YOU SEE A FACTOR OF A 5 FOLD INCREASE IN EUROPEAN WIND GENERATING ABILITY? THESE ARE NOT COMMITMENTS THESE ARE JOULES THESE ARE ELECTRONS BUZZING AROUND, NOW IF IT TURNS OUT, IF WE HAVE A TEN YEAR CYCLE, LIKE THE LAST TEN YEARS OR A BIT WARMER, WE STILL HAVE NATURAL VARIABILITY, EUROPE AND NON-EUROPE, AND CLIMATE ADAPTATION COST ARE LARGELY HIDDEN, AND ARE DIFFICULT TO TRACK. MITIGATION COSTS ARE HIGHER THAN WE THINK IN THINGS LIKE THIS. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC) ELECTORATES HAVE BEEN BATTLING AGAINST THIS TYPE OF THING. SAYING YOU TOLD US THIS WASN'T GOING TO COST THE EU.

POLISH ELECTRICITY. THE PROBLEM IS THAT WE SIMPLY DON'T HAVE ENOUGH POWER GENERATION CAPACITY TO PICK THE EXTRA DEMAND OF VEHICLES.

LM: THEN I WILL TAKE ANOTHER EXAMPLE FROM FRANCE. SOLAR WATER HEATERS, THAT IS AVAILABLE TECHNOLOGY AND PEOPLE HAVE BEEN DOING IT FOR TWENTY YEARS, AND THEY DON'T NEED MORE ENERGY ETC. IN FRANCE IF YOU LOOK FOR A PLUMBER THAT IS READY TO INSTALL THAT YOU ALMOST CANNOT FIND ONE, SO THAT IS ANOTHER INDUSTRY, IT IS NOT SUBSIDIZED, AND THERE IS NO SOCIAL NORM BECAUSE IT IS UGLY TO LOOK AT. SO IF YOU COMPARE THE WINDOW EXAMPLE WITH THE SOLAR WATER HEATER. YOU GET INTO THE COMPLEXITY THAT YOU ARE CALLING FEASIBILITY. THE CONCLUSION IS THAT THE MAIN EMERGENCY IS TO TRY VARIOUS PROGRAMS THAT ARE

YOU HAVE COMMITTED US TO A LARGE SCALE TRANSFORMATIONAL CHANGE AND YOU TOLD POLICY MAKERS IT WAS FEASIBLE AND WE COULD DO IT, BUT WHAT IF IT TURNS OUT TO BE REALLY EXPENSIVE AND TO CHANGE LANDSCAPES THAT ARE TRADITIONAL AND VALUED? WHAT ARE THE SOFT LANDING SPOTS WHERE POLITICIANS OR POLICY MAKERS CAN EXIT? WHAT DO POLICY MAKERS DO IF IT TURNS OUT TO BE INCREDIBLY CHALLENGING?

WHAT DO POLICY MAKERS DO IF IT TURNS OUT TO BE INCREDIBLY CHALLENGING?

LB: ANOTHER QUESTION I HAD IN THE CONTEXT OF WHAT YOU WERE SAYING EARLIER TO YOUR POINT THAT IF WE CANNOT ACHIEVE 80% BUT MAYBE WITH LESS AMBITIOUS PLANNING WE CAN ACTUALLY ACHIEVE 40% OR 60%. THERE SEEMS TO BE TWO ARGUMENTS FOR HOW YOU DO THAT. ONE IS THAT YOU JUST SAID YOU TURN IT INTO A SOFT LANDING CARD AND THEN INVEST THE REMAINDER INTO R&D OR

NEW TECHNOLOGIES THAT ALLOW THE DRASTIC CHANGE TO HAPPEN LATER. THE OTHER ATTITUDE THAT CAN BE TAKEN IS THAT YOU MAKE 80% A REAL EU PRIORITY AND PUSH HARD IN ORDER TO REACH IT.

DB: I HEAR THAT ARGUMENT A LOT AND I THINK THAT'S A DOMINANT ARGUMENT IN CLIMATE CHANGE. DON'T TALK ABOUT ADAPTATION BECAUSE IT FOCUSES AWAY FROM MITIGATION. DON'T TALK ABOUT CARBON CAPTURE AND STORAGE BECAUSE IT IS ABOUT DECARBONIZATION. PUSH HARD FOR A STRONG DEAL BECAUSE THAT IS WHAT WE WANT AND IF WE WON'T GET WHAT IS IMPORTANT PUSH HARDER. I THINK THOSE ARGUMENTS THEY ALL HAVE THE SAME POLITICAL RISKS ATTACHED. I COULD WRITE A DAILY ARTICLE OF WHAT IS ON MY MIND, IT WOULD PROBABLY BE ACCEPTED BY CLIMATE SCIENTIST, AND IT COULD PROBABLY DO A LOT OF DAMAGE. IN FACT ANYONE COULD. THE IPCC REPORT FOR INSTANCE WHICH IS ACTUALLY ON THE HIMALAYAS. IT WAS JUST A LINE IN THE REPORT, AND WHEN IT WAS SHOWN IT DID A LOT OF DAMAGE TO THE CASE. MY POINT IS THAT MISSING CERTAIN DIRECTIONS DOES YOU A GREAT DEAL OF DAMAGE ON ONE DIRECTION IN OTHER DIRECTIONS IT DOES NOT. I THINK THAT WE HAVE GOT TO UNDERSTAND THAT THE TERRAIN OF HOW COST THEORIES ARE USED AS TARGET THEORIES, FRANKLY IF WE REDUCE EMISSIONS BY 50% BY 2050 WE ARE PRETTY MUCH IN LINE WITH WHAT WE NEED TO DO, YOU COULD HAVE LOTS OF ARGUMENTS ABOUT THE THEORY. THOSE ARGUMENTS ARE MORE COMPLEX THAN PEOPLE REALIZE. THIS IS GOING TO BE MY SKEPTICISM OF THIS TARGET AS WE MOVE TOWARDS IT; WE HAVE SET OURSELVES UP FOR A FALL. I MEAN I HAVE MET WITH AMERICAN ENGINEERS; THEY ARE NOT REGARDED AS A CRITICAL TARGET. WHEREAS EUROPE HAS WORKED SO HARD FOR THIS PART ON THIS ISSUE THAT THEY JUST DO NOT THINK THAT IT IS THAT CRITICAL. IT IS HARDER TO TAKE SERIOUSLY.

KN: FIRST OF ALL I WOULD CALL THIS THE THIRD BEST ARGUMENT. IT IS A CLASSIC, YOU MAKE AN ANALYSIS, YOU AIM FOR THE FIRST BEST WHICH IS 80-100% BUT PERHAPS IT ACTUALLY WOULD GET YOU TO THE THIRD BEST OPTION, IF YOU ARE AIMING FOR A SECOND BEST BUT THAT IS AN UNATTAINABLE AND UNFEASIBLE FROM A PUBLIC OPINION STANDPOINT. ALL THESE PERVERSE EFFECTS THAT DAVID IS TALKING ABOUT WOULDN'T HAPPEN. THE SECOND BEST OPTION IS IN TERMS OF EMISSIONS, THE DEGREE THAT THIS ACTUALLY THAT IS SUSTAINABLE THAT IS FEASIBLE. BY GOING FOR YOUR FIRST BEST SUPPOSEDLY, YOU CREATE ALL THESE PERVERSE POLITICAL EFFECTS, AND SYSTEMIC EFFECTS, THAT MEANS THAT THE CITY IS NOT GOING TO BE ACHIEVED AND WE ARE GOING TO BE LOWER. THAT IS THE REASON, AND

THAT IS REALLY IMPORTANT.

DB: THE POLITICAL WILL JUST COLLECTS BEHIND THEM.

KN: THIS IS REALLY IMPORTANT BECAUSE THAT IS A VERY GOOD -COUNTER ARGUMENT, TO LETS AIM FOR BIGGER, BECAUSE AT LEAST WE WILL GET THERE.

S: YOU MENTIONED BACK-CASTING, I JUST FINISHED A PROJECT THAT IS ABOUT VISIONING FOR FRIENDS AND WE HAVE THE SAME ARGUMENTS IN BELGIUM THE IDEA WAS THAT PEOPLE KEPT ASKING ME, WHY ARE YOU PROPOSING 80%? WELL IF YOU PROPOSE 5% THESE PEOPLE WILL NOT WANT TO GIVE ANYTHING IF YOU PROPOSE 10%. OR IF YOU PROPOSE 10 THESE PEOPLE WILL TRY FOR 1% SO I THINK IN TERMS OF THE FUTURE, THE METHODOLOGY THEY ARE TRYING TO USE IS HERE MAYBE YOU SHOULD SPELL IT OUT AND SAY YOU KNOW MAYBE THERE ARE DIFFERENCED: ONE THING IS FORECASTING, WHICH IS USING THE CLASSICAL TOOLS OF ECONOMETRICS, WHICH IS FOR THE FEASIBILITY, AND THEN THERE IS VISIONING. BUT I ALSO AGREE THAT THINGS CAN ACTUALLY BACKFIRE I COMPLETELY AGREE WITH THAT POINT. BUT YOU HAVE TO REMEMBER THERE IS AN APPROACH HERE, THERE IS AN INTELLECTUAL APPROACH CALLED VISIONING AND THIS IS ABOUT ENERGIZING SOCIETY, AND HOW DO YOU DO THAT YOU ANNOUNCE A TARGET AND IT HAS TO BE A SUPER AMBITIONS TARGET. AND WE ALL KNOW THAT 83% WHICH WAS ANNOUNCED IS NOT GOING TO BE THE NET WE KNOW THAT. BUT WHERE DO WANT TO GET TO?

DB: I DON'T BELIEVE IN SEASONAL TARGETS THAT YOU INTEND OF GETTING CLOSE TO.

LM: I BELIEVE THERE IS A GREAT LACK OF BASIC THEORIZING IN CONNECTING FUTURE STUDIES AND NEGOTIATION THEORIES. I SPENT MY TIME IN FRANCE HEARING BRIEFS ON CLIMATE CHANGE COMMENTING JUST AS POLITICAL NEWS PAPERS WHAT THEY THOUGHT ABOUT WITHIN NEGOTIATIONS WITHOUT THE POSSIBILITY TO OBSTRUCT. AND AS YOU JUST DID TO DISTINGUISH THE EXPRESSION OF A VISION FROM A COMMITMENT FROM A SCIENTIFIC STUDY FROM A NEGOTIATION POSITION, ETC.

DB: THIS IS A CONCRETE BATTLE. IN NEW ZEALAND I WAS WORRIED THAT GREEN PEACE WAS ACTUALLY GOING TO GET AWAY AND THAT NEW ZEALAND MIGHT ACTUALLY SIGN UP FOR 40% REDUCTION BY 2020, WHICH FOR A COUNTRY THAT HAS THE INCOME OF SLOVENIA, IS DANGEROUSLY AMBITIOUS AND A WROTE A PIECE SAYING THAT WE PUT A CARPET FULL OF HOLES, BUT IF THE WORLD HAD TO REDUCE BY 60% BY 2050 THERE IS NO REASON WE HAD TO BE AT 40% BY 2020.

KN: THIS COULD BE A QUESTION OF THE WHEN DOES IT COST LESS AND WHEN DO YOU BENEFIT MOST.

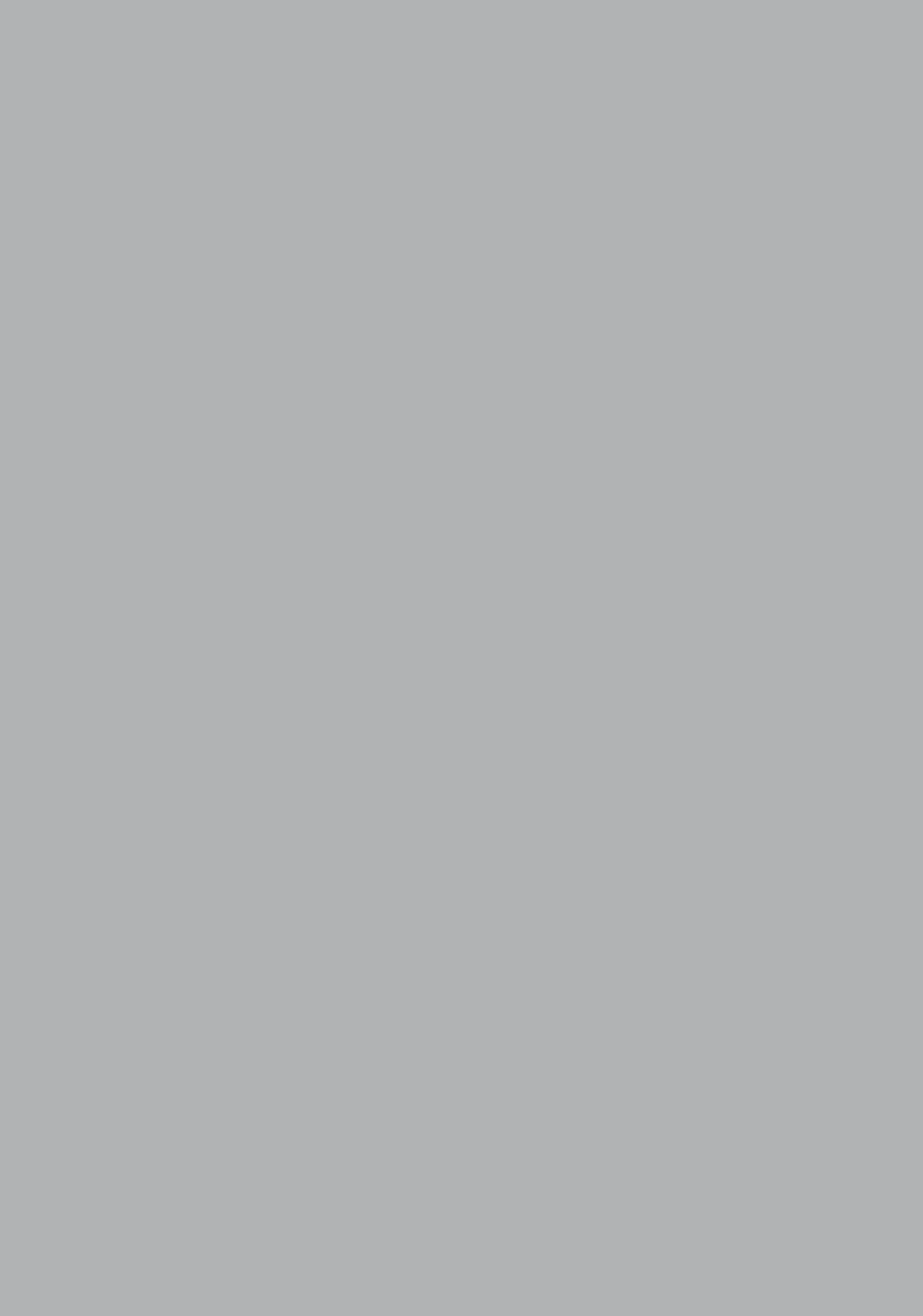
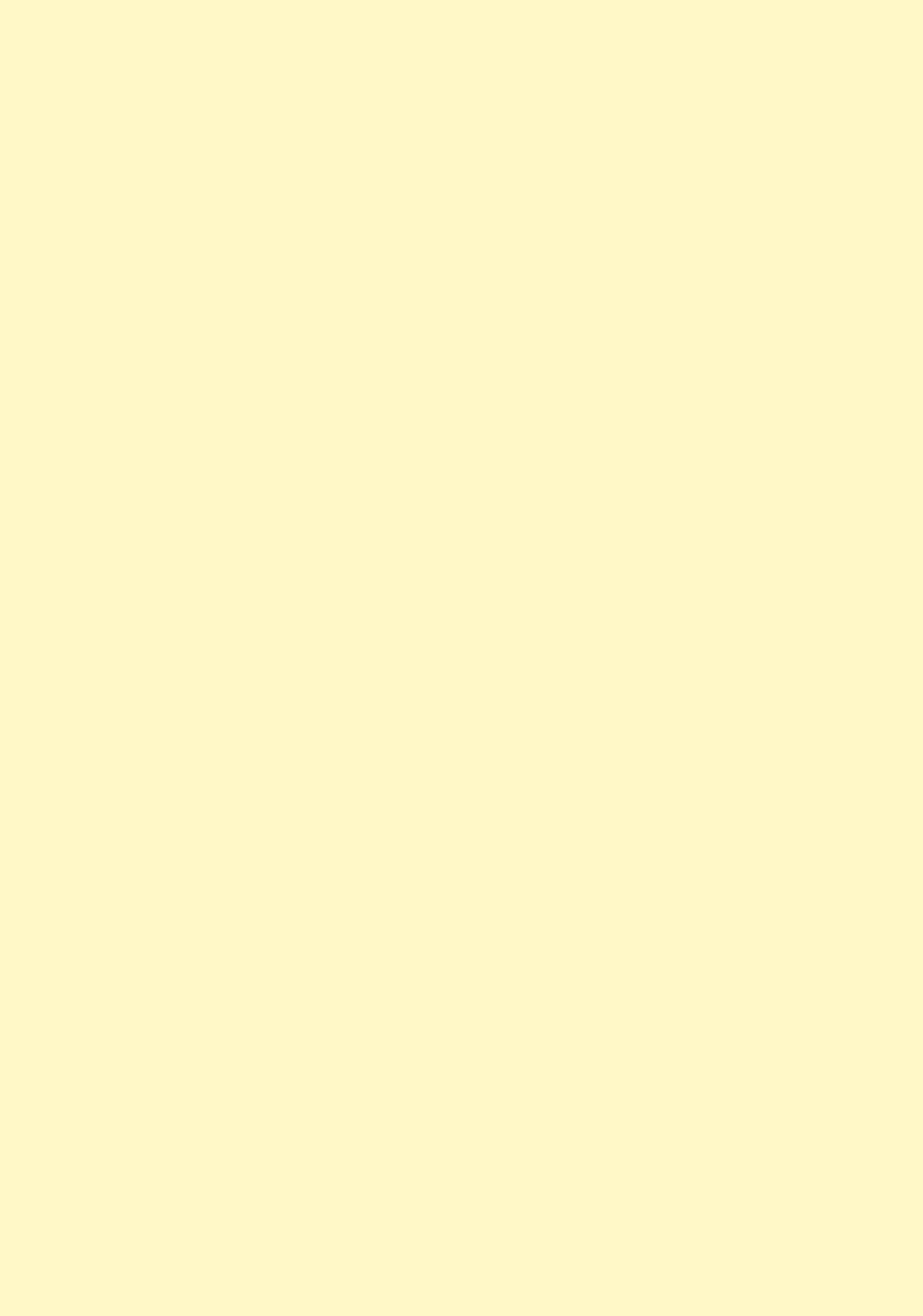
DB: THE WAY I WOULD DO IT IS TO SAY IS WHAT IS THE SOCIALLY CHEAPEST AND MOST FEASIBLE PATH TO GET TO 2050 WITH THE MOST BENEFITS? WHAT I AM ARGUING FOR IS A SENSITIVITY STUDY AROUND YOUR TARGET AND AROUND AREAS OF IMPORTANT AXIS, WHAT ARE THE SYMMETRIES OR ASYMMETRIES OF THE POLITICAL WILL OF MISSING YOUR TARGET OF THE COST OR RUNNING BY A FACTOR OF TEN ON EITHER SIDE PROBABLY HIGH BUT ON EITHER SIDE.

KN: YOU MEAN SETTING HIGH AND MISSING AS OPPOSED TO SETTING TOO LOW, YOU KNOW YOU ARE ALWAYS GOING TO MISS.

LB: WOULD PEOPLE BE MORE SENSITIVE TO MISSING A TARGET OR PAYING HIGHER COSTS? WHICH I THINK IS A GOOD POINT. WE DO HAVE A CERTAIN AMOUNT OF WIGGLE ROOM. WE DON'T HAVE TO AGREE AND PROMOTE EVERY SINGLE FACT THAT MCKINSEY SENDS OUR WAY. WE WERE ORIGINALLY APPROACHED TO WRITE THE VISIONARY NARRATIVE FOR THE CLIENT. WE COULD SAY THAT WE ARE GOING TO STEP BACK FROM THAT AND SAY WE ARE GOING TO PRODUCE A VISION AND BE VISIONARY IN OUR THINKING.

S: THE OTHER WAY IS TO LEAVE IT OPEN. TO HAVE, WELL YOU KNOW MORE ABOUT THIS THAN I DO, BUT TO HAVE A MORE NEUTRAL SET OF SCENARIOS. THAT WOULD BE THE ONLY WAY. SO IN A SENSE YOU HAVE VISIONING WHICH IS LESS NEUTRAL AND YOU ARE BIAS BECAUSE IT IS 80%. THIS IS ANOTHER APPROACH WHEREBY YOU WOULD HAVE FOUR QUADRANTS.

LB: BUT I THINK REGARDLESS EVEN IF YOU WERE USING THE DIVIDING APPROACH AND WE DID SAY 80% I DO THINK IT IS REALLY IMPORTANT TO TAKE ALL THE THINGS INTO ACCOUNT, AND GO AS FAR AS ASK WHAT THE POLITITIANS / PUBLIC / ETC.. A VARIOUS SET OF AUDIENCES THAT ARE GOING TO REACT MOST STRONGLY TO.



If you thought the **European Energy Grid** was just a dream...



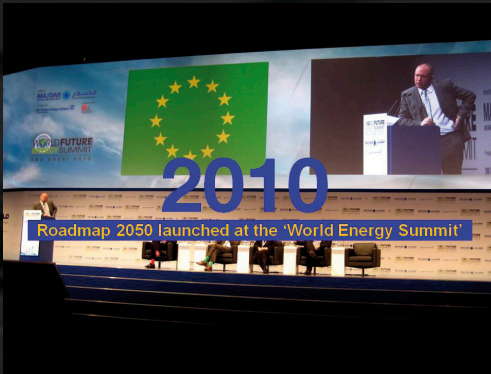
**2009**  
The Copenhagen failure



**2014**  
EU energy phasing process begins



**2015**  
EU launches 'smart infrastructure' campaign



**2010**  
Roadmap 2050 launched at the "World Energy Summit"



**2011**  
Russia turns off the gas



**2016**  
Petrol begins to be phased out



**2016**  
Sustainability race between EU & USA heats up



**2012**  
EU carbon tax introduced



**2013**  
EU begins building an EV network



**2018**  
Construction starts on the EU energy grid



**2019**  
Global oil peak occurs



2020 Turkey reaches de-carbonized targets and joins EU



2022 EU introduces carbon tolls



2026 UK reaches the 70% CO2 reduction target



2027 Prada launches new 'zero carbon label'



2023 Silver screen profits from green films



2024 UK opens desalination plant



2028 Frankfurt becomes world's first 'carbon sink city'



2028 Europe's universities focus on sustainable innovation



2025 Sweden leads in zero carbon housing per capita



2025 Dutch investors rush buy windy properties



2029 Ecological holidays become new trend



2029 Biomass plant make record profit in Romania

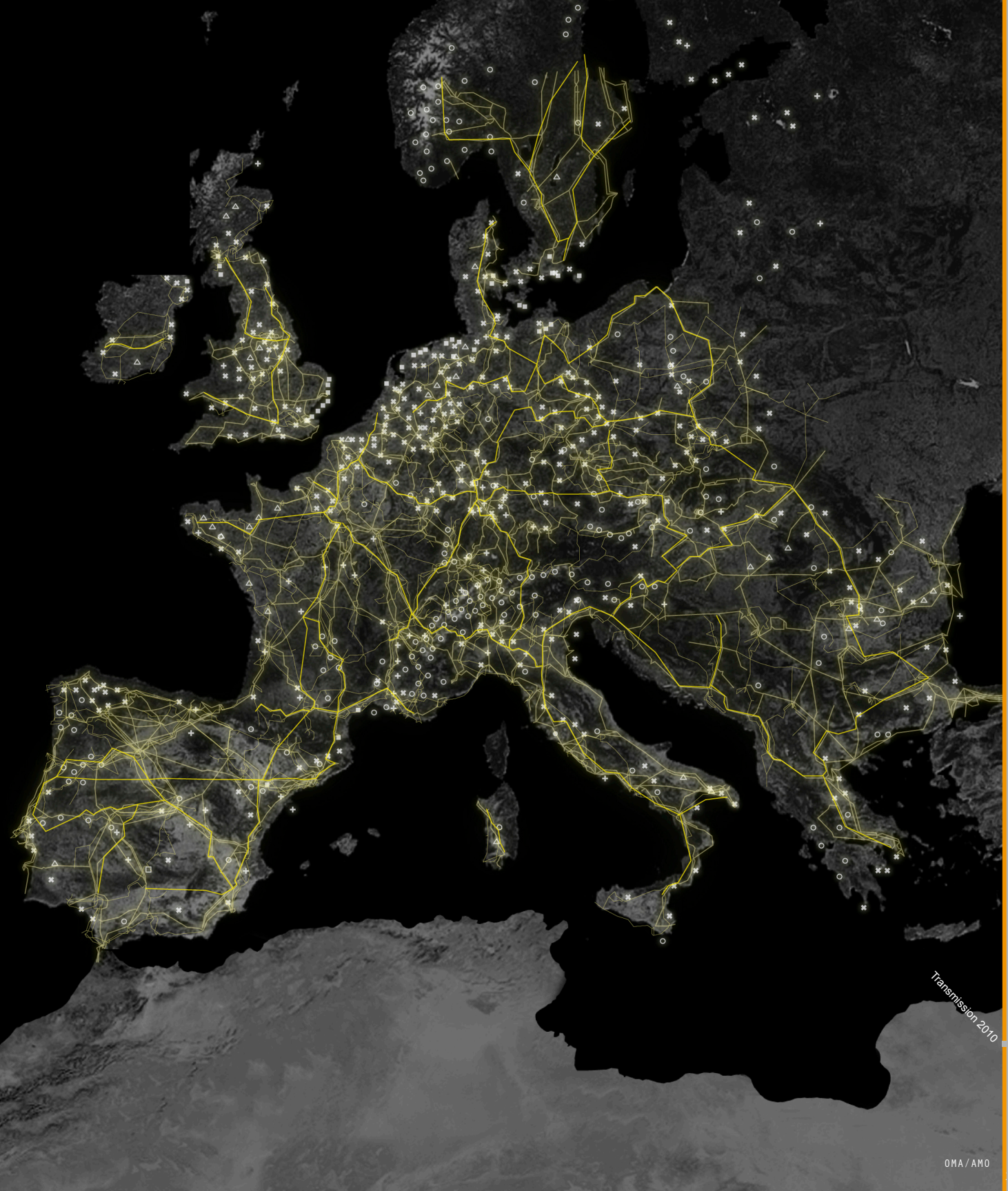
FFW



# EXISTING EUROPEAN GRID

## EXISTING POWER DISTRIBUTION

- SOLAR POWER
- WATER POWER PLANTS
- △ BIOMASS PLANTS
- WIND POWER
- GEOTHERMAL
- × COAL-OIL-GAS
- + NUCLEAR POWER PLANTS



Transmission 2010

# GRID PHASING

## EXISTING POWER DISTRIBUTION

- SOLAR POWER
- WATER POWER PLANTS
- △ BIOMASS PLANTS
- WIND POWER
- GEOTHERMAL
- × COAL-OIL-GAS
- + NUCLEAR POWER PLANTS



Grid Phasing



# COMPLETE GRID

## DECARBONIZED GRID POWER DISTRIBUTION

- SOLAR POWER
- WATER POWER PLANTS
- △ BIOMASS PLANTS
- WIND POWER
- GEOTHERMAL
- × COAL-OIL-GAS
- + NUCLEAR POWER PLANTS



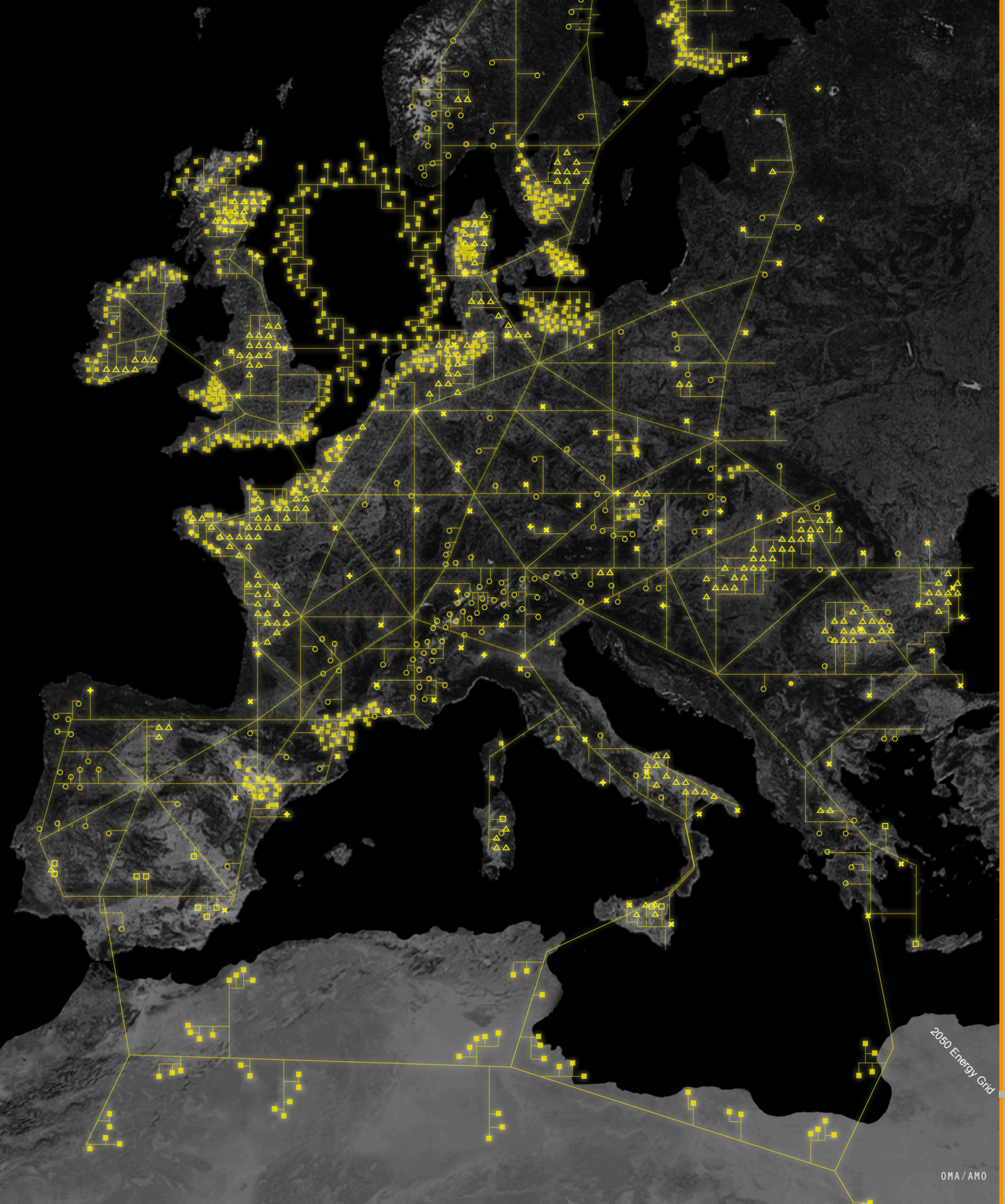
Complete Grid

OMA/AMO

# 2050 EUROPEAN ENERGY GRID

## DECARBONIZED GRID POWER DISTRIBUTION

- SOLAR POWER
- WATER POWER PLANTS
- △ BIOMASS PLANTS
- WIND POWER
- GEOTHERMAL
- × COAL-OIL-GAS
- + NUCLEAR POWER PLANTS



2050 Energy Grid

OMA/AMO

# EU 2050



Wind Farm



Nuclear Power Plant



Tidal Power



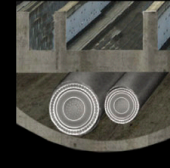
Biomass Plant



EVs in transport



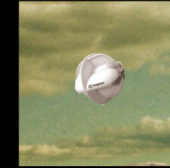
C.C.S Plant



Energy Network



Solar Farm



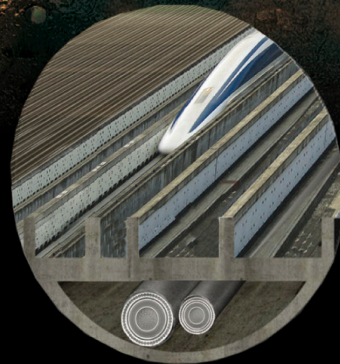
Technology Breakthrough



Solar Rooftops



THE NEW ENERGY GRID  
CAN BE COMBINED  
WITH TRANSPORT  
AND DATA LINKS  
TO PROVIDE AN  
EFFICIENT POST-  
CARBON DISTRIBUTION  
SYSTEM



100% Decarbonization

IF YOU THOUGHT THE EUROPEAN ENERGY  
GRID WAS JUST A DREAM...

...THINK AGAIN.





